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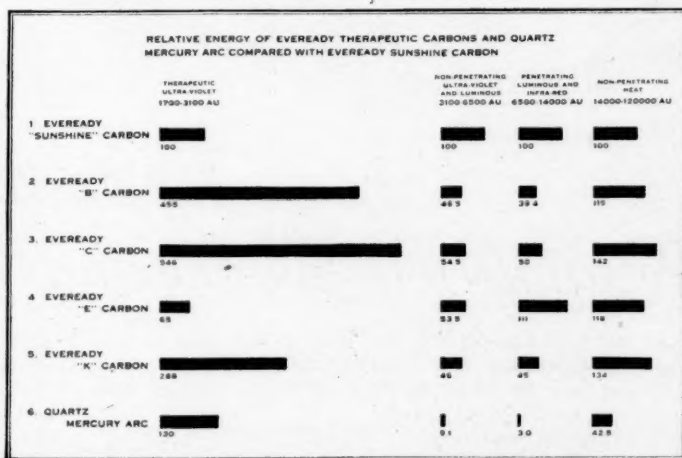
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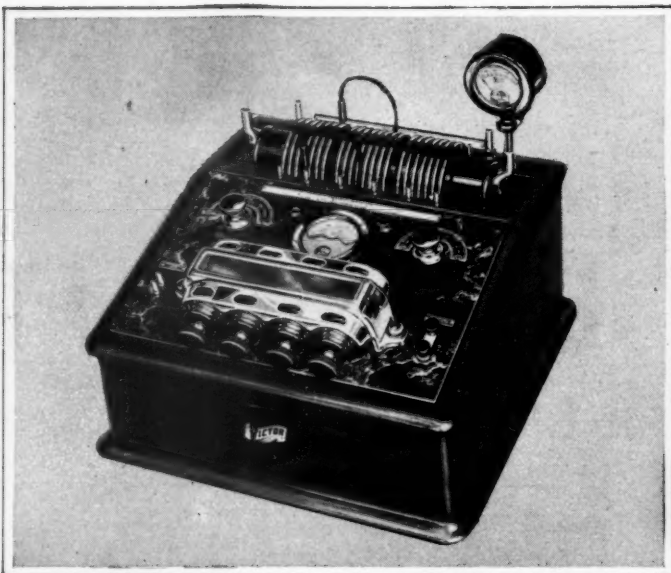
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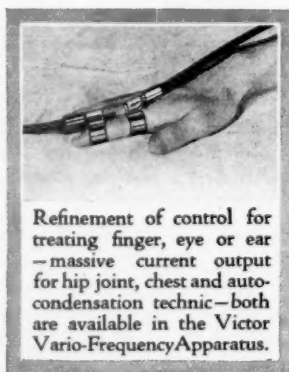


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PHYSICAL THERAPY IN INFANTILE PARALYSIS*

J. ALBERT KEY, M.D.

ST. LOUIS, MO.

For the purpose of treatment it is convenient to divide poliomyelitis into three stages: Acute, convalescent, and chronic. The acute stage begins with the onset of the disease and lasts until the tenderness and pain have entirely disappeared from the paralyzed muscles. Its duration varies from a few weeks to several months. During this stage the patient should be kept recumbent and the paralyzed muscles should be put at rest and kept at rest.

In order that a given muscle may be put at rest the joints which it controls should be immobilized in a position in which the muscle is relaxed. Where two opposing groups of muscles are paralyzed the joint is immobilized in the neutral position. For this purpose plaster of paris casts are most satisfactory. Not only are they always available, but a properly fitting plaster offers more complete immobilization than any splint with which I am familiar. After the plaster has hardened the cast can be bivalved for comfort. This method of treatment not only hastens the disappearance of the pain and tenderness, but also prevents the development of deformities. And it is to be remarked that deformities may develop very quickly and cause much unnecessary crippling.

I wish to emphasize the statement that no form of physical therapy should be used until the tenderness has entirely disappeared from the paralyzed muscles. Some years ago Dr.

Feiss¹ had the idea that early active motion of the paralyzed muscles would hasten the recovery and lessen the paralysis. Dr. Lovett permitted him to try his method on a few acute cases at the Children's Hospital in Boston. It was the opinion of those of us who saw these cases that the tenderness was increased and that the active motion did harm rather than good. The ideal treatment, then, of an acute case of poliomyelitis is to put the paralyzed muscles at rest and leave them severely alone.

The acute stage is followed by a convalescent stage which lasts two or three years. This stage is characterized by a tendency of the paralyzed muscles to recover their tone and power and this is the period during which physical therapy is especially beneficial and often is given credit for miraculous cures. It should be remembered, however, that there is a tendency to spontaneous recovery during this period and that in many instances the recovery would have taken place had no physical therapy been used. Consequently, it is very difficult to evaluate the effects of physical therapy as we have no method by which we can determine which muscles are going to recover and which ones are going to remain permanently paralyzed.

At this point it is well to consider our problem in order that we may intelligently use the methods at our command. The material with which we have to work is a muscle which is affected by flaccid paralysis on account of death

*Read at the seventh annual meeting, American College of Physical Therapy, Chicago, Oct. 10, 1928.

of or injury to the anterior horn cells which control it. Our problems are to better the nerve supply, to keep the muscle in such a condition that it will be able to respond to any nerve impulse which it may receive, and to increase the power of the muscle.

There is no known way in which we can benefit the injured nerve cells. It is, however, possible that we may be able to establish new synapses and communications in the cord by repeated attempts at active movement of the affected muscles. This is, of course, purely conjecture. The question of neurotonization of the paralyzed muscles by implantation of neighboring nerves has been tried from time to time, but has met with so little success that it is no longer used.

Since we can do little or nothing for the nerves we direct our energies at the muscles. We have practically no scientific evidence that we can in any way hasten the recovery of a paralyzed muscle by any method or combination of methods at our command. The experiments of Hartman, Blatz and Kilborn^{2 3 4 5} were entirely negative. They produced a flaccid paralysis in soleus gastrocnemius and plantaris muscles of both legs in a series of rabbits by cutting the sciatic nerves. The muscles on the right side were carefully treated by skilled physical therapists. The methods used were massage, and active contractions of the muscles induced by a slow surging galvanic current. The corresponding paralyzed muscles on the left side were used as controls and received no treatment whatever.

The animals were sacrificed at various intervals after the nerve section and the treated and untreated muscles were carefully compared as regards weight, appearance, and power. The power of each muscle was tested by their response to electrical stimuli after they had been placed in a specially constructed dynamometer. There were no demonstrable differences between the treated and untreated muscles.

In spite of the negative results quoted above, I am convinced that we can do certain things which will benefit a paralyzed muscle.

The teaching of Sir Robert Jones that a paralyzed muscle regains its power more readily if it is protected from being stretched has been borne out by the observation of surgeons all over the world until now it is accepted as the cardinal principle in the treatment of flaccid paralysis. This principle is that the paralyzed muscle must be protected from stretching.

A second fact which has been demonstrated by clinical and lay experience is that the power of a muscle can be increased by graded exercises.

A third fact which is not so well known, but which may be accepted as proven by ample clinical observation is that the power of a weakened muscle will decrease if that muscle is forced to perform too much work. The amount of work which a given muscle is capable of performing without injury must be determined by careful and repeated observations.

A fourth fact which has been proven scientifically is that the circulation in a given area can be increased by the application of local heat. Whether or not an increased circulation is beneficial to a paralyzed muscle is not known, but many physical therapists have observed that a weakened muscle contracts more readily and exhibits more power after it has been warmed and subjected to gentle massage.

We have, then, protection from stretching and over-work, graded exercises, and local heat and massage. These may be accepted as beneficial to paralyzed muscles, and their relative value is in the order mentioned.

Protection from stretching is the most important part of the treatment of any paralyzed muscle. It is accomplished by the application of splints of metal, leather, celluloid, plaster, or wood which support the part in such a manner that the paralyzed muscle is kept relaxed or in the neutral position. This support should be maintained until the muscle has regained sufficient power to support the part without damage or until all hope that it will regain such a degree of power is abandoned. This treatment not only aids the muscle, but it prevents the development of deformities. If deformities exist they should

be corrected as soon as practicable in order that these paralyzed muscles may be relaxed.

Voluntary exercises are second only to protection from stretching and strain in aiding paralyzed muscles to regain their tone and power. But to be of value the exercises must take the form of carefully supervised muscle training and the muscles must be protected from fatigue and over-work. It is well known that over-work will cause a weakened muscle to lose rather than gain strength. For this reason the exercises must be very light in the beginning and the muscle protected from strain in the intervals between treatments.

In instances where the muscle is too weak to move the part against gravity the movements should be assisted by the physical therapist or the patient can be placed in water and the exercises carried out in the pool. The effect of the water is merely to neutralize the force of gravity and thus enable the patients to carry out the prescribed movements with less effort. But many men feel that this is so important that specially constructed swimming pools (under-water gymnasiums) are now a very important part of some institutions where the treatment of infantile paralysis is carried on extensively.

A muscle chart should be made at the beginning of the treatment and the affected muscles should be examined at weekly intervals and the findings recorded and compared with the previous observations. If a given muscle is found to be losing strength it is probably due to over-work rather than to lack of exercise and the muscle should be rested a few weeks and then started again on a less strenuous course of exercises. As the muscles become stronger the movements can be carried out against resistance which is furnished by the physical therapist, by some form of exercising machine, or by the patient himself.

There is no especial type of exercise which is beneficial in infantile paralysis. The exercises are devised by the physical therapist to fit the particular case and are so arranged that they involve the contraction of the paralyzed muscles and cause them to perform the desired amount

of work. It is advisable that the exercises be as simple as possible in order that they may be performed accurately. Complicated movements are apt to be confusing to the patient. In the treatment of young children games and toys may be of considerable value in encouraging the patients to perform the desired movements.

It is to be emphasized that success in muscle training is not dependent upon the use of expensive and complicated exercising machines, but is achieved by the intelligent direction of a physical therapist who is conscientious in his work and sees that the muscles perform the correct amount of work and are not weakened by over-work. Exercising machines are of value in that they enable the physical therapist to set the patient a definite task to perform, causing the muscles to work against a definite amount of resistance or with assistance, and thus treat several patients at the same time. But no exercising machine has yet been devised which can take the place of human intelligence.

Heat to the paralyzed muscles is usually applied in the form of a simple electric baker, but diathermy or moist heat or some other form of dry heat may be used. There is no evidence that any particular type of heat is especially beneficial. The heat is followed by gentle massage and this is followed by the muscle exercise. It is to be emphasized that the heat and massage are of no value unless they are followed by the muscle training.

I have said nothing about the use of various forms of electricity in the treatment of infantile paralysis because I do not believe that they are of practical value, but may do more harm than good because they are apt to divert the treatment from muscle training which is of the utmost importance. The same is true of the use of the various forms of light therapy and even of heliotherapy. Ultraviolet light and heliotherapy may be used for their general effect upon the patient, but are not to be regarded as agents for the restoration of paralyzed muscles.

In the chronic stage of infantile paralysis physical therapy has the same field of usefulness as it does in the convalescent stage, but the

results are apt to be less striking because spontaneous recovery has ceased and many of the muscles are permanently paralyzed. However, one is often surprised to find muscles which have been paralyzed for years respond to a well directed course of rest and muscle training. The methods of treatment are the same as those described above in the treatment of the convalescent stage.

In the chronic stage, after deformities have been corrected, physical therapy is especially useful in restoring muscles which have been weakened by prolonged stretching. It is also useful in restoring function and increasing the power of muscles which have been transplanted and thus caused to perform new and often opposite movements.

To sum up the treatment of infantile paralysis in a few words, the paralyzed muscles should be put at rest and left alone until all pain and tenderness have disappeared. In the convalescent and chronic stages rest and carefully supervised muscle training are the only methods which are known to have a beneficial effect upon the paralyzed muscles. It is also to be emphasized that physical therapy is a useful adjunct to the surgery of infantile paralysis.

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DISCUSSION

DR. CHARLES JACOBS (Chicago, Illinois): I think you will all agree with me that Dr. Key has presented

a very interesting paper. He has told us what to do and when to do it. He has not been over zealous in claiming results because we know (in fact it is well known) that in some cases what we accomplish is remarkable and in others we accomplish nothing. Why do certain so-called paralyzed muscles recover and others not? That, of course, depends upon the pathology.

Let us take the cross section of a cord, and, as the doctor has stated, the diseases in the anterior horn, represented by these x's, the cells. Let us say that the disease represents certain cells, represented by the stars. Those cells which have been affected are dead, and there are no impulses from these cells to the muscles, and the muscles are absolutely paralyzed and it makes no difference what we do, nothing will regenerate those muscles or the cells. On the other hand, as a result of this infection, we have an inflammatory exudate. That inflammatory exudate presses upon the other cells and results in paralysis. Those impulses have been pressed upon, causing a pressure paralysis. Therefore, we may have a paralysis of the upper extremities or of the lower extremities. It is in these cases that we get spontaneous recovery, because the exudate gradually absorbs.

The doctor has spoken about these weakened muscles. I think we should differentiate between the so-called weak muscles and the paralyzed muscles, but how can we differentiate? We can not. Time alone will tell us what are the weak muscles and what are the paralyzed ones.

As to physical therapy, the first thing in the case of infantile paralysis, or poliomyelitis, is rest, whether it be in the acute state or the convalescent stage; rest in bed in the acute state, rest in the wheel-chair in the convalescent stage, but rest from weight bearing. We must, at the same time, as the doctor has told you, protect the weak muscles from stretching, because a stretched muscle will act as if it was a paralyzed muscle. Therefore, I say we must, in speaking of results obtained, differentiate whether it is in the so-called weak muscle or the so-called paralyzed muscle. If the muscles are really paralyzed, that is by invasion of the disease of the cells, nothing is going to bring back power.

The doctor has said that muscles which have been paralyzed for years respond to a well directed course of rest and muscle training. I am sure he does not mean the paralyzed muscles. I am sure he means those apparently paralyzed muscles, of which it is true. We have all seen a muscle which has been stretched, a weak muscle, for instance by the foot being in the position of equinus, by contraction of the tendon of Achilles, and that muscle is stretched; let us correct that deformity, bring the foot up in dorsiflexion, and soon power returns to that weak, stretched muscle.

I believe I am in full sympathy with everything else that Dr. Key has said so far as heat, muscle training, and those things are concerned, I cannot add to that. I agree with him perfectly that electricity plays no part in the treatment of poliomyelitis.

There is just one other statement I wish to make, which is about the use of circular plaster casts. Personally, I believe that a circular plaster cast in poliomyelitis increases the amount of atrophy to the part. Therefore, if I am using a cast, I much prefer to use a posterior molded cast splint rather than an entire circular cast.

DR. F. H. EWERHARDT (St. Louis, Missouri): I was pleased to have Dr. Jacobs emphasize the matter of stretching. It has fallen to my lot to treat poliomyelitis for quite a number of years. In about 1915 we had a rather severe epidemic of poliomyelitis around St. Louis, and at that time physical therapy had just come into its own, at least it had just started. We thought at that time that if massage and exercise was good in small amount, perhaps more would be better. So we exercised and massaged this deltoid muscle more than we should have done.

In about a year we realized that something was wrong. We took the arm and put it in an airplane splint in the abducted position and kept the arm for a year in that position. We instructed the mother not to allow the arm to come down to the side of the body during the entire time. Only we ourselves would do that. We heated the shoulder joint, or the muscles, and after very gently massaging and very careful, graduated, exercise, we regained probably ninety per cent of the muscle. Today the little girl can raise her arm just as I raise mine. At the end of one year's treatment, with the arm unsupported, she could not raise her arm. I rather feel that this is an illustration of the case where the unsupported arm causing stretching prevented the recovery.

DR. RÓY W. FOUTS (Omaha, Nebraska): I want to second what Dr. Jacobs said about circular casts. I believe that more damage is done by putting circular casts on different parts of the extremities and body, anywhere for that matter, and leaving them, than good is done. The custom of doing that is productive of damage. A partial cast, a posterior splint, an internal splint, or whatever sort of splint is required for the particular occasion, is much to be preferred to a circular cast that completely encases the extremity, if the extremity is what we are treating, or, better still, perforated celluloid casts or something of that sort, to permit air and light to get to the affected part.

We have all seen extremities put up in casts, for instance a broken arm, left only for a few weeks, perhaps, and when the casts are removed the muscles are atrophied and it requires some time for function to be restored, whereas if they are left out just on a splint where the air can get to them, that does not happen.

I must say that I think electrical appliances, particularly some form of sine wave or surging galvanic current, such as the doctor mentioned, is of value in the restoration or redevelopment of the remaining muscle. Along with that must come a more valuable thing, the power of the patient to transmit nerve impulses to those muscles. You can't do it, in any way that I know, with the technician or physician bending the finger or the hand or any part that he wants to move, and saying, "Now you help." But you can put on a surging current properly applied so as to exercise the muscle that you want, and with slow contractions instruct the patient each time, "You do it." If you train the individual to send down through the cord and through these cells that are left and out over the nerve that impulse, it will finally do the thing itself.

I believe that this type of electrical treatment is of value, and here is where the big help comes, that you must train the patient and get him to help any time there is an impulse and have him perform the movement. If it is an ankle you want lifted, each time it comes, he helps. After a time, you get the reestablishment of your nerve impulses to the muscle. In that way the patient acquires a useful muscle, which otherwise, if you massage it, might not happen. If you do not have a nerve that is capable of carrying an impulse, you have nothing.

I believe that is a point that is worth while being borne in mind. Educate your patient to do it himself, and after a time he gets so that he can.

We must be able to recognize the amount of work that can be placed on any muscle or group of muscles. We must recognize that all important thing, to protect the weakened muscle against the pull of the uninjured muscle. At the proper time, I believe electrical currents will be of benefit.

DR. J. ALBERT KEY (St. Louis, Missouri): In regard to the definition of paralysis, Dr. Jacobs and I perhaps differ a little bit. I regard any muscle which is affected at all as paralyzed, not necessarily completely paralyzed, but muscle enervation from the central nervous system is not at all or nothing. Muscle contraction is an all or none phenomenon for the fibers involved, but the muscle as a whole receives its impulses from many nerve cells. In these muscles, of course, any muscle which has any decrease in its power is partially paralyzed. The amount of that paralysis may be very great or very little. I feel that it is a question of so conserving the strength of the fibers which are not paralyzed that they will in a measure compensate for those that are and build them up to a point where they are above their normal capacity, also will prevent them from being stretched.

As regards plaster casts, of course I stated that I always bivalve the plasters. Sometimes we use

posterior molds, sometimes we leave on the top too. I think it is a good deal in the way the plaster is put on, I mean if the plaster is put on properly, I have never been able to see that it made a great deal of difference in the amount of atrophy, whether it went all the way around or half way around. I think it is the immobilization rather than the shutting off the limb from the sunlight that is the cause of the atrophy. I have had just as much atrophy, it seemed to me, in treating fractures with splints as I have with plaster casts, and it seems to me that it takes the muscles and the joints just about as long to come back.

One thing that I did not emphasize in the paper that perhaps should be emphasized is that it is remarkable how the joints in limbs affected by poliomyelitis can stand prolonged immobilization without becoming stiff, whereas the same joint after a traumatic injury, if treated in the same way, would take months of hard work in order to get it loosened up.

As regards electricity, I have always felt that contractions of muscles induced by electricity ought to do some good. I have quoted you the only scientific work, so far as I know, that has ever been done on this subject. These observers went into this proposition with the desire to prove that electricity was some good to a paralyzed muscle. When they got through with the muscles that they had treated very carefully, it was the proposition of the Canadian government to determine its policy toward its disabled soldiers, and the muscles which had been treated were no better whatever. I am perfectly willing to be convinced that electricity or sinusoidal wave inducing contractions of the muscles is of benefit. I don't use it; I don't object to it, I don't think it does any harm. The only point is that it puts the patient to a lot of expense and the doctor, or whoever is doing it, to a lot of trouble, and so far as I can see it does not have any definite benefit.

PHYSICAL MEASURES IN THE TREATMENT OF PAIN*

R. J. BEHAN, M. D.

PITTSBURGH, PA.

Pain is present in about 95 per cent of all diseases, and is frequently the first sign which attracts the patient's attention to the fact that something is wrong in his or her body economy.

In order to intelligently treat pain, certain fundamental basic physiopathologic information should be at hand concerning the production, the transmission and the perception of pain.

First of all, pain to be perceived must be induced in the periphery and then be carried by nerve fibres to proper centers, when it is perceived. In these receptive organs or localizations various impulses are co-ordinated and correlated to each other and are given the interpretation "*pain*." A pain, as you know, is the only perception of impulses deleterious and dan-

gerous to the organism. These impulses may originate in either the cognitive centers for pain perception or in other centers.

The influence of irritation either by toxins or by disturbances in blood supply, when so originated, are forwarded to the cognitive center for pain which is in the optic thalamus. For all central (cerebral) impulses which may arise in toxemia and in hysteria and in malnutrition of the cerebral cells themselves, direct means of treatment are not available. A toxin may produce centralized disturbances which manifest their presence by peripheral pain, which is termed headache. Headache, therefore, is the peripheral reference of pernicious changes, localized either directly in the afferent sensory tract or in the central terminating cerebral zone. Ultraviolet radiation will relieve such headache by increasing the calcium content of the blood,

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thus raising the threshold entrance restraint of noxious stimuli. In headaches of a toxic origin there is usually a reduction of the calcium content of the blood. Toxic headaches are dull and heavy, worse in the morning and better in the evening. In treatment, increasing the calcium content of the blood is most necessary. The calcium content of the blood may be increased directly by injection of calcium salts properly prepared into the circulation or indirectly by the application of ultraviolet radiation. The general well-being and pleasant reactive increase of functional activity which a person experiences after ultraviolet radiation undoubtedly has some effect in reducing nerve irritability and thus contributes in an indirect way to the relief of pain.

From the central organs to the receptive fibrils at the termination of the sensory nerve fibre is a long distance, bridged by the sensory nerves with their component neurons. Any disturbance to the sensory fibres of the nerve may cause pain to be perceived as coming from a region in which the terminal fibrils of these nerves are distributed. This pain is interpretative in terms of its causative origin. We all know the peculiar characteristics of an inflammatory pain, particularly the throbbing which represents relaxation and compression of the terminal sensory fibres which occurs in an inflamed area each time the heart beats and more blood is sent into the congested area.

Such a pain may occur anywhere on the body. Sensory terminal fibres are distributed all over the body, except in tissues supplied by the sympathetic system, by the vagus, and by the splanchnics. These supply the internal organs—the heart, the lung, the liver, the gastrointestinal tract, the spleen, the kidney, the pancreas, the ovaries, etc. In these organs which represent perhaps the oldest and most essential structures of the body, is the oldest established relationship between the periphery and the cerebrum. The impulses which they convey are not so much concerned with protection, as with existence, i. e., with the physiologic balance between the different organs essential to life. Most of the harmful impulses which are sent to the brain are reflexed back before they reach the

main brain center in terms of protective acts, such as nausea, faintness, etc. The harmful impulses from the somatic system (that is the system concerned with the peripheral and external relationship of the body) are reflexed back from the center in terms of defense movement, activity and the tendency to move away from the harmful forces. These reflexes produce contractive defensive states such as is present in the fixed and rigid abdomen in peritonitis, or such as occurs in fixation of joints, in arthritis; these contractures are protective and inhibit harm to the organism. Reflexes and defensive acts of the organism against impulses deleterious to its existence, which are interpreted in terms of pain, must be considered in all our efforts to formulate plans of treating pain.

The methods of relieving pain are greatly varied and embrace every form of physical therapy. In physical therapy we should include all therapeutic measures except mental suggestion and psychotherapy, because all therapy is fundamentally physical. However, in my considerations of physical measures of therapy, I exclude all remedies which are taken internally, or which are injected into the body and all procedures of a directly chemical nature which are applied either in the form of drugs or of biological products. It is extremely difficult, however, because of the interaction of different measures to definitely and sharply segregate the different systems one from the other. It is undoubtedly true that basically all activity of our body is of an electrical nature. At least functional activity is the result of the reaction of positive charged electrons with negatively charged electrons, and likely it is the deflection of these charges one way or the other by different measures that produce the therapeutic results which we are seeking. We are very indefinite in our fundamental knowledge as to how such results may be produced in the primary elementary processes. We are, however, very certain of the gross results of our treatment. I mentioned the central disturbances which produce pain. I now wish to transfer our attention to influences acting on the peripheral terminations of a sensory neuron which may produce pain. We know that there are definite pain receptors whose only duty it is to receive impulses which are trans-

ferred to the sensorium and there are perceived as pain. These receptors are much more numerous in certain areas, as in the extensor surface of the hand and the skin of the abdomen than they are upon the skin of the back. In places where they are more numerous, pain sensation is more acute. Therefore, measures for the relief of pain must be more effective in areas where the sensation is more easily produced. The noxious influences that the receptors are particularly subject to, are those which pertain to injury of the part. This is providentially so because receptors of this character have been developed through long ages of evolution for the very purpose of perceiving harmful interference, so that defensive activities may be set in motion. The injurious influences which produce peripheral pain may be either chemical or physical. The chemical influences giving rise to pain are those in which there is an accumulation of deleterious products around the terminal sensory filaments. Such a state is induced when the blood supply of a part is lessened to such a degree that anemia, severe enough to be destructive to the tissue cells,¹ results. Such a pain is produced where the circulation is obstructed.

In disturbances, especially, as is marked in progressively advancing thrombosis, as in diabetic gangrene or in thrombophlebitis obliterans where a peripheral area of the circulation is obstructed. In the tissues supplied by this circulation we find that there is at first a very marked and extremely severe burning pain. But as soon as gangrene definitely develops, that is, as soon as the tissues themselves all become dead, and cellular disintegration is taking place, the pain ceases, at this time the nerve itself is involved in the degenerative process and cannot convey pain sensation. We see a similar phenomena induced where a tourniquet is placed too tightly upon a limb and severe pain results. This is particularly so when a very tight splint is applied and cellular death occurs in the part below the encircling splint. How, by physical measures, can we relieve such pain? Certainly it is impossible to particularly influence and arrest the destructive changes which in such processes is occurring in the limb. Local heat seems to be of some corrective value, particularly if the limb is swathed in cotton

bandages, and external heat without pressure is applied. Diathermy may also be of some value, especially if it is applied high above the lesion on the limb; a high frequency current applied over the location of the afferent sensory nerves would produce some interruption to the conduction in the nerve itself, and thus induce at least a temporary surcease of agony. The physical measure of therapy which is most conducive in such cases is the direct injection of alcohol into the nerve supplying the involved area. Surgical interference, i. e., sympathectomy of the artery supplying the painful region is of potent value, for by dilatation of the peripheral vessels it brings more blood to the part and hinders cellular death. Where, on the other hand, the local production of pain is the result of a toxin which is carried to the part from some further removed source, there are two plans of treatment; one is to deaden the receptivity of the nerve itself, and the other is to remove the toxin. In the first method we apply ice; in the second we use heat. When the vessels are contracted and the nerve is not too deep in the tissue and not too far removed from the surface, its conducting activity is lessened. If, on the other hand, we use heat the vessels are dilated, the toxic material is carried away and the nerve itself apparently is soothed so that its receptivity is reduced. The pain is thus relieved. We find the latter condition present where acute inflammation and a chronic state of cellular disturbance exists in the part. When inflammation is present in the part, there are two causes for the pain. One is the presence of toxin and the other is the effect of pressure. In an inflamed part we not only have cellular destruction with the liberation of toxin, but we have also increase of pressure in the part, so that not only tension is made upon the nerve terminal but direct forceable infringement on the receptive structures occurs with the production of pain. The first factor, i. e., the presence of toxin, can hardly be relieved by further dilatation of the vessels directly in the inflamed part, but may be influenced by heat applied below the part, or by surrounding the part, with cold applications, directly to the involved part itself. The throbbing character of the pain is due to the entrance of blood through dilated vessels in the involved area. The increased volume of blood

is suddenly opposed and halted in its progress by the static and immovable mass of blood in the inflamed area. This immediate stoppage of the onward flow with a sudden increased pressure in the part, causes pain, throbbing in character, each throb representing a heart beat. A reflex producing blood vessel contraction occurs and the pain eases, to again reoccur as the blood is forced into the part by the pulsations of the vessels.

The throbbing of a pain in these conditions, in fact in all inflammations, whether septic or otherwise, provided the lesion is located on an extremity, can be very definitely relieved by a Bier hyperemia bandage applied above the inflamed area. By means of this bandage hyperemia is produced in the inflamed part and the pressure is equalized, the change from a high degree of positive pressure to a less degree is modified, and the pain is relieved. It is extremely interesting to see how quickly a perfectly applied Bier hyperemia bandage will alleviate the pain in an inflamed and very distressing lesion of an extremity.

Changes in relationship of irritated nerve filaments to adjacent structures with consequent pain is produced by movement, so nature herself indicates a plan of treatment, by immobilizing the abdomen over a painful appendix or a painful lesion of the viscera. Painful disturbances of joints are relieved by the joint being immobilized by contraction of the controlling muscles. The same procedure is applied by nature in every painful lesion by fixation of the part involved. A similar plan of fixation is induced by the surgeon either by splinting or by change of position in order to bring the parts into such relationship with their surroundings that pressure is least upon the inflamed areas. Such physical measures of treatment as splints and casts and orthopedic appliances I feel it is not part of my exposition here to detail.

Local physical changes in the peripheral receptive terminal filaments for pain reception may be due, as I mentioned before, to changes in tension of the part, such as occur in inflammation. In addition to Bier's hyperemia one should not forget that radiant heat is very bene-

ficial, at the same time the ultraviolet light has curative activities which are extremely advantageous. Changes in pressure on the terminal sensory nerve filaments may also be due to new growths, in the form of scar tissues, of neoplasms, of pressure from malposition of organs or viscera or by malposition and harmful adjustments of one part to another, or sometimes by pressure of ligatures, etc., following surgical operation.

Scars when they produce pain, especially if nerve tissue is imbedded in such scars, and if the tissue itself has begun to proliferate and to form a new growth, can only be permanently relieved by excision. Painful scars themselves, however, can frequently, by the use of x-ray, be softened and then permanently eradicated by the use of the ultraviolet light and by diathermy. Combination of one or many modalities should always be undertaken in such conditions. As a surgeon I am of course impatient of such slow methods and prefer excision of the disturbing tissue, predicating, however, that care should be used to inhibit the return of such fibromata by beginning, as early as possible after operation, the application of x-ray and ultraviolet light.

Neoplasms can only be removed by surgery, in some cases by the radiation of x-ray or radium. If the neoplastic growth is of metastatic origin and malignant in nature, it is best to use radium or x-ray; first thoroughly heating the part, either by a through and through diathermitization, or by radiant light. For such growths, even when they involve the nerve fibres themselves, I prefer the direct implantation of radon seeds and have had remarkable success in ameliorating and relieving the distress of such conditions.

Another group of cases in which pressure is the cause of pain, are those in which there is a spasm of the sphincter openings of the body, such as the pylorus, the intestine, (colic) of the anus, bladder, the cervix uteri.

Pain in hollow viscera, as the intestine, etc., are the result of dilatation proximal to obstruction—of the gall bladder, and the pain is

due to distention of the gall bladder and the kidney pelvis. It is very likely that spasm of the cardiac end of the stomach does not produce pain unless there are some other disturbing factors. Spasm of the pylorus may produce pain by incidentally causing a dilatation of the stomach with contraction of its muscular coat and pain production. In the cardia of the stomach no such acts can take place because if there is a contraction of the cardia of the stomach, the so-called cardia spasm, though dilatation of the esophagus sometimes takes place. In contraction of the cardia at the esophagus opening, a dilating force is not present to a sufficient extent to cause pain, and as it is extensive only from the accumulation of food in the esophagus, regurgitation of food and vomiting will occur.

Pain from anal sphincter pain, and cervical uterine pain, (the so-called dysmenorrhea) can be very definitely relieved by the use of the galvanic current. I find also that the galvanic current is extremely useful in cases of painful sphincter contraction especially of the anus where a fissure exists. In such a case I also perform an over-dilatation either under local anesthesia or by giving the patient nitrous oxide gas. Over-dilatation is also carried out in cases of vesicle sphincter contraction and in cases of painful contraction of the os uteri. In the latter instance cervical dilatation may be done without anesthesia with a minor degree of pain but it is bearable. If necessary novocaine may be injected laterally to the cervix, and this will relieve all painful sensation. For vesicle sphincter dilatation, I find that cocaine locally applied to the mucosa of the urethra with a small quantity injected into the bladder will render the procedure painless. I find that strangury and tenesmus associated with cystitis in females is very definitely relieved and the cystitis is quickly cured by such a degree of over-dilatation of the urethra that a temporary incontinence of urine occurs. This temporary incontinence of urine allows immediate drainage of all irritating products in the bladder with quick relief. In conjunction with the dilatation, the bladder may be irrigated and antiseptic and soothing solutions introduced into it. All these measures in reality are measures of therapy.

Changes in the relationship of the component parts of a tissue, or organ, so that pressure or traction is made upon the terminal nerve filaments may produce pain. We see this type of pain exemplified in joints and in tissue of the viscera. Viscera have no direct pain sensation. We are entirely unaware of what is taking place inside our abdomen, or inside our chest, or inside our head. We are unaware in a general way whether there is a hyperemia or an anemia, or whether the activities which are taking place are beneficial or otherwise. The only viscera sensation that we have is that which is the result of distention. The visceral nerve endings have never been developed to receive peripheral sensory due to touch, cold, heat, pinching, etc., which are somatic, defensive sensory impulses, but are particularly receptive to the changes which result from disturbances of their own well-being and interference with their function. These are particularly associated with distension. Practically the only sensations coming from the viscera are those which are the result of distension of such organs. This is exemplified in the liver, whereby a sudden distension due to engorgement will produce pain. Such a condition we also find in heart disease when compensation is suddenly overcome and the liver becomes markedly engorged.

Pain is also present in gall-bladder disease when the gall-bladder on account of blocking of the duct by a gallstone will suddenly become overdistended and give rise to very severe pain. Similarly produced pain occurs in lesions of the intestines and of the kidney. These pains are referred to the surface of the body in well defined areas which have a nerve association and relationship with the deeper organs. Treatment of these areas of the skin by the production of hyperemia in them will frequently relieve pain in the deeper organs. This is exemplified in the use of irritation plasters for the relief of congestion in pneumonia, also for the relief of pain in intra-abdominal lesions. Ultraviolet radiation will also relieve these pains. Cold will sometimes relieve such pain because cold reduces the sensibility of the peripheral nerve filaments and the deeper viscera are disconnected from their peripheral distribution association so that referred pain of vesicle origin has no somatic

area to localize itself and becomes lost as it were. Advisedly, I say localize itself, for there never is in such cases a pain in the peripheral terminal sensory fibres. What occurs is that the peripheral sensory filaments are sensitized by the deeper visceral lesions and respond to stimuli of a less threshold value with the sensation of pain, so that a slight touch upon the skin which otherwise would be unnoticed causes severe pain. These areas of referred hyperaesthesia have well defined boundaries and are associated very definitely with particular internal viscera. They are termed head zones, and in many cases aid us to more easily interpret disturbances in the underlying viscera.

Joint distention is a very potent cause for pain in different varieties of arthritis. This pain is due to tension. Compression over the joint is frequently of great value and may be produced by placing a large dry bath sponge over the joint and holding it in place by several layers of muslin or gauze bandage applied around the joint. When such a sponge is moistened by a suitable solution such as saturated solution magnesium sulphate, the sponge absorbs the fluid and expands so that equable and direct pressure is made upon the inflamed joint. Fixation of such a joint is always to be undertaken.

Elevation of the part is also used in all cases where inflammation is present in an extremity, especially where there is a throbbing pain.

Pain also results from pull and drag upon ligaments and bands by disturbances of equilibrium, such as we find in club feet, in muscular defects and in back strain. Such strains occur from occupational malposition as in those who work over desks either too high or too low, or who assume faulty postures and strange positions as clerks working at a desk or mechanics when occupied at a work bench. Such back strain also occurs among very stout people who throw an excessive pull upon a congenitally weak back, or in cripples who have defects of postures so that excessive drag is thrown upon a restricted group of muscles.

At present I have under treatment a young lady who is a cripple from the results of infantile paralysis. One limb is paralyzed and is almost totally useless. She was, however, comfortable and managed with crutches to get about fairly well. However, she became very stout and a greatly increased stress was thrown upon her one good leg and on the shoulder girdle of the same side because of the crutches which she used. She developed very severe back pain which began only when she had become stout. The pain I associated with the excessive strain consequent upon the great increase of weight. At the time of consultation she weighed 180 pounds. On reducing her weight to 145 pounds the back pain disappeared, and as long as her weight remained at this figure it did not return. However, when she again permitted herself to grow stout, and when the weight approximated 170 pounds, the pain reappeared.

In this case the pain represented a static defect due to lack of balance of stresses between the ligaments and muscles of the back. The weight caused a pull and drag upon the supporting ligaments and structures, in the above patient, beyond their point of tolerance, so they respond by pain production.

We may also have pain produced directly by irritation upon a nerve, this irritation may occur anywhere between the terminal filaments and the central sensory perception area in the brain. Irritation may be caused by localized toxemia in the nerve such as is occasionally exemplified in the neuralgias. If the irritation progresses further it produces inflammation and neuritis results. In many of such conditions we find there is, (especially in sciatica) an edema or thickening of the perineurium. Traction upon such a nerve may relieve the pain as hyper-extension of the thigh sometimes relieves sciatica. Diathermy gives great benefit. The weak current is more effective than the strong current, especially in the early stages. Sometimes the pain is temporarily increased as soon as the diathermy is applied. Pressure upon the nerve should of course always be avoided and any irritating contacts with the terminal areas where sensation is

more acute should be avoided. A plaster cast or splint is very good in such cases as they give absolute rest.

The x-ray is used in the treatment of many cases of terminal nerve pain due to toxemia, and in reflex pain, and also in neuritis. It seems in some cases to be beneficial. Pain from pressure of bands, from apparatus, faulty positions, etc., should always be relieved by the proper meacohol injection has sometimes been used to reures. Alcohol injection has sometime been used to relieve the nerve pain, especially the pain of a facial neuralgia.

The local application of cold in the form of an ether spray I have found to be extremely beneficial in many examples of referred pain, especially the pains associated with the cranial nerves.

The pain as a result of neuralgia of the brachial or the sciatic, or the lumbar plexi, may be treated by diathermy through the part involved. An attempt may be made to influence radiculitis; however, this is very difficult as the nerve roots lie inside the vertebral canal, it is practically impossible to introduce heat through the bone. A condition of this sort may not be influenced by physical therapy, nor can the transmission fibres in the cord itself as they pass up into the brain be so influenced. By no means of physical therapy can we influence those tracts either in the cord or in the brain. There may be certain referred pains which, as I stated before, are influenced by application upon the surface of the body to which the pain is referred. Diathermy, plasters, etc., everything which produces a change in the circulation of the surface will produce some change in the related viscera with which the skin area is associated.

It is an interesting problem and is most seductive to speculate upon the future possibility

of desensitizing nerve fibres by vibratory impacts, so that the transmission of pain impulses are blocked, as it were, and not pass through. I believe such a blocking is possible and that we can, by interrupted current of sufficient frequency, block off nerve pathways so that local anesthesia and lack of sensation may be produced in a part. As a surgeon, measures of such a nature are not alluring. In surgical practice I use nearly all of the modalities, I have a technician, and until recently had a physician associated with me who was familiar with the application of such therapy, and I am well satisfied that I have done my patients much more good by personal observation and supervision of these methods of treatment, than if I would send them to someone who was not familiar with their particular type of disability and the therapeutic results which were desired. I also believe the end results in such patients were much better than if they had been without such treatment.

I believe that the surgeon can enhance the benefits he confers on his patients, if, after operation, he will refer them to those who are equipped with physical therapeutic measures so that ensuing benefits may be made permanent. Treatment to enhance metabolic activities and production of hyperemia, either by light or diathermy and to increase elimination through the intestines by diathermy applied to the abdomen, are measures of extreme post-operative importance, especially important after operative interference on internal viscera, and in those patients in whom formation of adhesions is marked. I believe also that there would be less post-operative ileus if shortly after operation diathermy could be given. Patients with post-operative shock are markedly relieved from the physical manifestations of such shock by the entrance of heat into his body. As a surgeon I find physical modalities indispensable in both pre and post-operative treatment of my patients.

IONIC MEDICATION*

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The use of the electric current to cause chemical substances to enter living tissues is a subject upon which considerable experimentation has been made.

The decline in the use, but not in the importance, of galvanism in recent years has been due to the application of newer methods, which were substitutions only for the constant current. Such original workers as Leduc of France, the late Dr. Massey, and our distinguished guest, Dr. Friel, have maintained that with proper technic and a just appreciation of the fundamentals of the constant current much may be accomplished—the prevention of needless surgery with resultant scar tissue formation, and the possible extension of the original lesion by re-infection.

Students seem to have difficulty in grasping the meaning of the term *ion*, because respective writers have used different interpretations to describe its action. This has led to confusion, and has made the comprehension of the subject vague.

In Dr. B. Burton Grover's recent work, "High Frequency Practice," he gives as lucid an explanation as possible:

"The number of protons and electrons in any atom in its normal state is the same. When one or more of the electrons escape from an atom, it is left positively charged, and the atom to which the escaping electrons become attached, is changed negatively. An atom which becomes electrically unbalanced is an ION."

All chemical and physiological processes are due to reaction between ions. Life itself can only be maintained by their free movements, and death also calls for their free play in the presence of water in reducing complex bodies to simpler compounds.

Definite concentrations of ions on either side of membranes through the laws of osmosis, is the basic process underlying growth, nutrition and decay, as well as the production of functions.

The terminology as applied to electrical processes, is not so difficult to understand if one will only give thought to the meaning of the words used.

Electrolysis in therapeutics is the local dissociation of tissue by means of the negative pole of the galvanic current. Osmosis is the transmission of liquids of different densities and composition through membranous or porous septa.

Cataphoresis is the passage of the galvanic current from the positive (often called the anode) pole to the negative (the cathode) pole. Anaphoresis, conversely, has its influence in the dispersion of the radical ions from the negative to the positive pole.

An electrolyte is an ion in motion between the poles of a galvanic current capable of chemical dissociation by that current.

Many have doubted the question of ionic decomposition, but Leduc explains that it is the ionic movement or transportation which is itself the electric current. Ionic transportation in inert media, dead animal tissue, and in living tissue, is easily demonstrated.

To make it more comprehensive we shall take a typical demonstration. In a vessel containing zinc chloride, suspend two platinum strips, connected with a battery. It will be found that zinc appears at one strip and chlorine at the other. These strips are really electrodes. The zinc is precipitated, and the chlorine forms plantinic chloride with the platinum. The decomposing current enters at the strip connected with the copper or negative plate of the battery and this strip is called the anode, or positive.

*Read at the seventh annual meeting, American College of Physical Therapy, Chicago, Oct. 10, 1928.

The current leaves at the strip connected with the zinc or positive plate of the battery and this strip is called the cathode, or negative. Thus it will be seen that the zinc travels with the current to the cathode, and the chlorine against the current to the anode. These components are accordingly called *ions*, from a Greek root meaning "to go."

The positive current goes from the zinc to the copper and carries zinc with it; hence the zinc is called electropositive. The negative current goes from the copper to the zinc and carries chlorine with it; hence, the chlorine is called electronegative.

In ordinary osmosis the liquids must be different. But even with the same liquid on both sides of the porous partition the passage of an electric current from one side to another will cause more liquid to diffuse in one direction than the other. This is called electric osmosis, or cataphoresis. More liquid passes by diffusion through an electrolyte in the direction of the current than in the opposite direction. The process may be shown by using a weak solution of starch and a weak solution of iodine, separated by a porous partition. The current on passing from the iodine to the starch will carry some of the former with it, thus coloring the starch by chemical reaction with the iodine. This process plays an important part in medical applications of the electric current, or the process known as cataphoric medication.

The indiscriminate use of drugs, even with the proper pole as the active electrode for penetration, is usually unsatisfactory or productive of negative results. However, from the conclusions drawn from actual results, by Dr. William J. Morton, Dr. Cleaves and Sir Lewis Jones, besides those already mentioned, who have been close friends and co-workers with the writer in experimenting along these lines, I feel that we can honestly assert that ionic medication has a place in medicine of greater importance than is usually accredited to it.

The depth of penetration of the surgical ions—zinc, copper, silver, etc.—may be esti-

mated by the eye, the depth of staining having an accurate indication, as for instance, zinc will show a white color about the needle, and in the softer subdermal tissue, the extension will be noticed over a greater area. In granular tissue a still greater penetration will be seen. The amount of diffusion will always depend upon the strength and duration of the current, which must depend upon the toleration of the patient, unless an anesthetic is used.

However, valuable ionic diffusion may be introduced by surgical applications to diseased tissues. We should not be deluded with the expectation that a large joint or deeply seated nerve can be reached, but direct diffusion of one or two centimeters may prove to be of great medical or surgical benefit.

The principle underlying the transition of ions in minor surgery is that the current is able to develop and disperse sterilizing ions through any thickness of granular tissue or other infected areas in a focus of infection to the extreme limits of the deposit in an easily controllable manner, instead of acting only on the surface to be quickly washed away as in the case of ordinary applications of germicides.

Massey says: "These surgical ionizations of germ deposits and focal lesions are in effect electrochemical curettage, with the important difference from surgical curettment that with this procedure the absorbent vessels and lymph spaces in healthy surrounding tissue are not opened, but sealed by the coagulative action of the ionization until this is replaced by tissue repair."

The metals commonly used for local destructive or sterilizing effect are zinc, copper and mercury. Zinc alone where a mass is to be removed, using several zinc applicators at once or zinc with mercury amalgamation; copper alone or amalgamated, according to the operator's preference, and mercury when applied by amalgamating a gold or platinum tip. All instrument dealers carry in stock various shaped copper tipped electrodes but few, however, have on sale zinc electrodes, probably because of the

lack of demand or because of the brittleness of the metal.

There are, however, sufficient conditions found in a surgeon's everyday work when actual surgery can be prevented and the parts operated upon left more nearly intact than by any other method. The technic is simple when zinc or copper ionization is to be used. If an operation of any extent is to be undertaken where large milliamperage is to be used and an anesthetic given, a large electrode or several smaller ones must act as the dispersing area, because of skin resistance. If on the other hand, only a small operation is at hand, like a nevus or a mild application to cervix with local anesthesia, one or two modern asbestos surface electrodes will answer the purpose. What has just been said about the diffusion of drugs applies to conditions which may be considered as surgical, or when topical applications of the same or similar drugs in paste or solution are used. It is not an infrequent practice by physicians familiar with and using galvanic current in their practice, to use a solution of cocaine on a carbon electrode, using the positive pole to literally drive the drug into the tissues for the relief of pain as in local anesthesia. Quinine, aconite, in aqueous solution or in a solution of guaiacol, chloroform and glycerine or other compounds are used for superficial pain. These drugs are easily demonstrated as the effect is usually perceptible at once. When drugs are so utilized, the ions thus diffused do not act as a cauterant or astringent, as with zinc or copper, but form a union with intracellular substances and confine themselves to local action in the tissue adjacent to the seat of application.

The use of drugs for solutions where the immersion of a foot or hand, for example, is the part to be treated, must be done with the usual precautions taken as regards metal contact of receptacles used, which means porcelain or glass enameled metal or wooden containers. Solutions, whether of chlorin, from chlorid of sodium, lithium from lithium chlorid, salicylic ion from sodium salicylate or iodine from a solution of iodid of sodium, all of them from 2 to 4 per cent strength, are the usual formulae.

Where local applications are to be used, when the immersion of the part is not practicable, electrodes covered with the best absorbent cotton, thoroughly saturated, the base of which for the positive pole must necessarily be carbon, platinum or gold; aluminum may also be used where the current strength is small. Because of the expense of the others, carbon or aluminum is usually adopted. For the negative pole, aluminum will meet all occasions. It is an essential part of the technic that the part to be treated should be thoroughly cleansed by ether, alcohol or some similar preparation which will remove oily particles from the skin and present the best absorbent surface. The solution, whether in a receptacle or absorbent cotton electrode, should never be used in tap water, but in distilled or rain water, as other mineral ingredients might interfere with the transfusion process. As for instance, if cocaine were to be used, which calls for the positive pole, and if there were in the water other mineral substances that could be driven in only by the negative pole, the interference of the process is obvious.

The therapeutic indication is the guide for the drug selected; as for example, if it were a case of gout, the lithium ion would be the one selected; if arthritis, the chlorin ion; if indurated areas, iodine ion, and for local antiseptic effects, salicylic ion.

The selection of the pole that applies to the specific ion, if one forgets, is easily ascertained by referring to almost any one of the modern text books, and the strength of the current.

Different kinds of ions have different effects on the tissue. Some ions remain unchanged and others enter into chemical combinations in the tissues. Some ions, such as copper, iron and calcium cause pain, while others, like the salicylic ion are well borne.

DISCUSSION

DR. J. U. GIESY. (Salt Lake City): There seems to be a lot of confusion among the newer workers in this field as to what ionization is. It cannot be better described than in the paragraph Dr. Morse quoted, for

which I will ask your consideration long enough to re-quote: "The number of protons and electrons in any atom in its normal state is the same." The thing that distinguishes whether a thing shall be a hydrogen ion or atom or an atom of human tissue is simply the number of electrons and protons constituting the basic atom of that substance. Consequently, there is only one thing that can cause ionization, and that is the disturbance of the normal equilibrium of the atom. Consequently, an ion is nothing except an unbalanced or imbalanced atom. Either it has a number of its electrons shaken loose, or it has a number of adventitious ions added, an atom in that condition, is an hysteroidal atom which immediately tries to readjust itself, or, in other words, an ion.

Ionization, broadly speaking, is of two origins, from solution or from solid substances, as Dr. Morse pointed out. That goes without saying, except to stress one point, that the ratio of ionization from solution is inversely with the concentration of the solution, and that is why we use weak solutions because the rate of diffusion in ionization is much more rapid in the weak solution than in concentrated solution.

About the only other point that I think I could possibly make is what happens in ionization. These substances, these ions, these hysteroidal atoms that are seeking to regain their balance, having lost it, are picked up, as it were, by the electrical force, and they literally build a bridge of moving atoms or moving, unbalanced ions.

We think of a current of electricity as flowing in one direction. Actually it does not do anything of the kind; it flows in two directions at the same time.

When these ions get into the tissues, when they have penetrated under either the negative electrode or the positive electrode, what happens? They do not penetrate very deeply. In both, essentially, if the current is actually a streaming of ions between the two poles, there must be a certain penetration for the entire distance between the two poles. But there is a rule of concentration which follows which produces a greater concentration nearer the portals of entry than in the deeper tissues between the poles. These substances enter the tissues, however, and they do one of two things. They maintain their chemical characteristics or they unite with the intracellular substances of the body to set up what amounts to albuminate or protein compounds within the tissues. They are then taken up by the system either in the form of direct chemical absorption or a slow absorption of the albuminate compound.

In ionization, as in other forms of the use of galvanic current, we follow the same strict technic as in the application of electrodes with other apparatus. Good application means good results; even contact means smooth flow of the current and a minimum amount of cutaneous resistance or danger of causing

your patient discomfort. Consequently if you are using solid ionization, keep your electrode points clean.

DR. A. R. FRIEL (London, England): With regard to this subject, I just want to say two or three things. It is necessary to take into consideration in treatment certain physical and anatomical conditions. One of the prime conditions for success in treating any lesion is its accessibility. There is not much difficulty or question about the accessibility of ulcers and that sort of thing on the surface of the body, but there is very considerable discussion and theoretical difficulty about the accessibility of the internal organs. This was pointed out some years ago by Professor Leduc, and these diagrams were designed by me to show what is meant by accessibility.

The most direct path between two points is not always the quickest way for the current to pass between two points. If somebody is able to put a piece of tin outside your leg, the current runs by the substance which conducts electricity the best; it would run around that tin and the bone would escape all, or almost all action of the electric current. The thing actually does take place when you attempt to treat a nerve in the center of the leg, because it is surrounded by muscles, and muscles are very good conductors of electricity. A great deal of the current runs through the muscle sheath, and a little of the current would reach the center of the leg.

The absence of the muscle sheath is the favoring circumstance whereby ionization of lesions in the brain are made a proper and simple procedure. There is no muscle sheath worth talking about on the surface of the skull, and when the current is made to travel to the brain, the current actually does go through the brain preferable to going through the skin and subcutaneous tissue on the surface of the skull.

This method of treatment is not employed by many people, largely for two reasons. One is they never thought about it, and the other is that they are afraid to apply the electric current to the brain. There is no risk whatever, I understand from Professor Leduc, and from what I have seen in making an electric current pass through the substance of the brain.

What other means have you of acting on the tissues of the brain? What medicine can you give in sufficient amount that will act on the tissues of the brain and improve nutrition, except by making an exchange between the ions in the vessels in the brain and in the cells in the brain? That can be accomplished and so far as that goes, can be easily accomplished by the continuous electric current.

If any of you care to look up Professor Leduc's paper on the diseases in which it is most indicated, you will find it in the Archives of Radiology, an English journal. The paper was published seven or eight years ago.

There was in my mind for some time confusion about the depths of penetration and what happens when you do pass currents through the soft tissues of the body, and, if we use salicylate of soda, how far we introduce it. We all like making experiments, or seeing other people make experiments, and it is natural to draw conclusions from them. The experiments we make are almost always made with things at rest, and the depths of penetration which were illustrated by the slides are largely dependent on the strength of the current; it is also dependent on the chemical substances which are formed. If you attempt to introduce salt into a solution of albumin in the laboratory, taking for example a salicylate of soda and perchloride of iron you can see the depth of penetration. Suppose you try to introduce silver into albumin; you will find it is very difficult to do, because the silver forms an insoluble compound with salt, so what you get when you try to introduce silver is to get a crust on the surface of the albumin. When you introduce zinc into albumin, the penetration is considerable. The reason is that although zinc forms an insoluble compound with albumin, it forms a soluble compound with chlorine; so there is a path for chlorides in the tissues, and hence a path for zinc to enter.

When you want to introduce zinc into a depth in the living body, you must use current proportionate to the depth to which you want to introduce it, but you also need to have a substance which forms both a soluble and insoluble compound. The reason for the difference between the experiment in the laboratory and the experiment in the human body is that in the human body there is a stream of moving blood, and if you introduce into the human body an ion which forms soluble compounds with the ions in the tissues, if you introduce cocaine or strichnin or morphin, in a very short time the strichnin or morphin is taken up by the blood stream and transported, so you don't actually introduce the strichnin deep into the tissues. But if you use a substance like zinc, you do introduce it as deep as you like, because the zinc forms an insoluble compound with albumin and stops the blood stream; it forms a soluble compound with the salt and there is a path for deeper penetration. That is the reason, or one of the reasons that zinc is so useful in the treatment of septic areas where the septic area is covered by granulation tissue or in the endometrium.

Although it is practically impossible to introduce drugs deeply into the tissues, such as salicylate of soda for the treatment of rheumatism, that is not by any means saying that the electric current has more effect on deep tissues. It has a great effect on deep tissues. The electric current in the tissues is the movement of ions, and the ions that are in the blood cells and in the tissue cells are made to move, the ions are taken out of the blood cells and put into the tissue cells, and this metabolism or nutrition is the explanation of the benefit that follows treatment by the electric current in most cases. When we use salicylate of soda, we

soothe the superficial nerves and relieve pain but we do not introduce salicylate deep into the tissues.

DR. CURRAN POPE (Louisville, Kentucky): I have been a continuous and uninterrupted user of the galvanic current for thirty-eight years. I sat at the feet of two of the greatest masters, Beard and Rockwell. Beard and Rockwell wrote a book of approximately four hundred and fifty pages on the galvanic and faradic currents, and it is doubtful today as to whether there is any better book on those currents published in the English language.

I make nearly all of my own zinc electrodes, nearly all of my own copper electrodes. I think that zinc has a very selective action, especially in those cases, as Dr. Friel said, in which you can macroscopically clean the tissue, but you cannot microscopically clean it.

In zinc we have a metallic ionization in which we will dry and harden a relaxed tissue and produce an antiseptic effect, which is achieved, in my experience, by nothing else in medicine. It has been in my hands a metallic ionization that is less irritating than copper and, in fact, I practically never use copper alone. Copper I prefer amalgamated, and in this way use the copper mercury method.

The possibility of driving these ions into the tissues, if any of you are in doubt, you can easily demonstrate to yourself by taking a uterus of a rabbit and ionizing it with copper and seeing the greenish stain that will penetrate.

I wish to say this about the galvanic current: It is a current of opposites. If you need the positive pole and do not recognize that need and use the negative pole, you are producing diametrically the opposite effect from what you desire, and vice versa. So, while it is applicable to all other currents, it is doubly applicable to the galvanic current in that you must not only know the physics of your current, you must not only know its physiological action upon tissue, you not only must know its chemical action upon tissue (and, incidentally, oftentimes its mechanical effect upon tissue, for it may cause a muscular cramping), but you must be absolutely possessed of accurate, clear, clean-cut knowledge of the difference of the polar reactions of this current.

I have been greatly interested with the number of talks that Dr. Friel has given us and the interesting slides that he has shown, and I am glad to know and to feel that I have on any number of occasions duplicated the work that he has so graphically described. Those of you who have been trying to inject a sinus, for instance, with a syringe, to wash it out and clean it up, if you will resort to zinc ionization once you will never again employ such a poor substitute for something that is almost an absolute specific. I have seen a foul, tortuous sinus heal.

Remember that the first thing that a man should do in physical therapy is not to obtain a machine, but to obtain knowledge, not only of the currents, but of their effect in the various domains of physiological activity, and then be shown and taught their relationship to pathology.

DR. FRANK H. WALKE (Shreveport, Louisiana): In the use of those fissures I have always found it better to use a local anesthetic, not on account of the pain, but on account of the relaxation. The sphincter is so

very tight that you can't get a good broad field. If you use a speculum to stretch it so you can see it, it is extremely painful. I inject usually about one per cent butyn solution. If desired, perhaps one could ionize with cocaine. I use a local anesthetic and the patient is satisfied. The placing and stretching with the mucosa and laying the electrode in the right place, will cause pain. It is very irritable, because of the spasm of the sphincter muscle. For that reason, I think local anesthesia is good to use.

X-RAY NEGATIVES OF MAXIMUM DETAIL AND CONTRAST*

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INTRODUCTION

A "good x-ray negative" is a question of much argument. Some roentgenologists prefer negatives "black and white;" others prefer a light film, depicting bone detail, "light" in appearance, and visualization of more or less soft tissue. The type of negative turned out by most laboratories represents the choice of the roentgenologist-in-charge; other laboratories find it difficult to make really diagnostic films of any kind.

The purpose of this paper is to supply an outline containing such data as will furnish a working basis for those who desire to adopt this type of technic. We desire to state at the beginning of this thesis that it is only a preliminary report which sets forth the methods used by us for obtaining a "contrasty" negative. Such details as are considered valuable in assisting the roentgenologist, or technician, as the case may be, to improve his technic will be included in this present paper.

"LONG WAVE" TECHNIC

The technique employed by us has no name; it is merely spoken of about the laboratory as "long wave" technic, which indicates that we are employing the very softest x-rays

possible in the "raying" of the parts of the body under examination. A long wavelength, as most of us know, means a low K. V. Calculation shows that the intensity of the rays rises with the square of the E. M. F. used, but that the degree of absorption which takes place in the bromide of silver of photographic films, or in the cells of animal tissues, diminishes so rapidly, that the rise in intensity due to increased voltage does not produce effects which are in proportion to this rise; they appear to us much smaller than we have expected.

For diagnostic purposes, it is of great importance that the quality and quantity of the rays should be suitable for the object, because the amount of detail obtained varies with the quality of the x-rays used. It must be just sufficient to penetrate the part of the body we wish to examine, and when this is the case we obtain maximum detail and contrast, and even the slight difference in density, caused by tuberculous lesions, bone pathology, renal calculi, etc., will become visible. The further the penetrating power is increased, the more of the finer details will become transparent, and outlines become obliterated by the scattered rays.

Under-exposure cannot save the detail, neither can it help contrast when too much penetration is used for the part being examined.

*Received for publication June 3, 1929.

"Long wave" technic is not new; it has been used by some operators to roentgenograph leaves, flowers, snakes, frogs, chicken's eggs, etc., and to some little extent it has been used in medical roentgenography. In most instances, however, it has been used without knowing its significance. The trend of roentgenographic technic of late years has been to keep all factors constant, except voltage, and in a few instances measure the part being examined.

Variation of voltage, of course, means variation of wave length; but the selective wave length for the part under examination has, heretofore, been unattainable. The selective wave length for the part being examined depends upon the atomic weight, the specific gravity and the thickness of the media. Every media has its own coefficient of absorption, but this coefficient is by no means constant, it varies widely with the wave length of the x-rays used.

There can be no really set rule for x-ray exposure except where a careful measurement of the part being examined, and the selective wave length for that part is taken into consideration.

We have found that for a given thickness a specified wave length is necessary if one desires to obtain maximum contrast and detail. We have also found that not only does each thickness of parts require a selective wave length, but the various organs of the body require selective wave lengths as well. In this preliminary report, we shall give only such data as applies to extremities. A subsequent thesis

will supply information regarding stomach, spine, chest, gall bladder, spleen, teeth, skull, pelvis, etc.

Exposures for these parts are being carefully considered spectrometrically, and we are not yet prepared to furnish adequate technic. However, for those who are using "constant time" technic, we will add that, for chests, gall bladders, kidneys, and stomachs, less trouble will be found than in the application of "constant time" to bone work. "Constant time" is a very difficult technic unless the auto-transformer of the x-ray machine being used is supplied with a large number of "taps." (One hundred buttons are necessary; a flexible auto-transformer is a great aid to long wave technic, also.)

Many x-ray machines have certain mechanical limitations which will be discussed in Part II of this paper.

To do long wave technic successfully, there are two things absolutely essential:

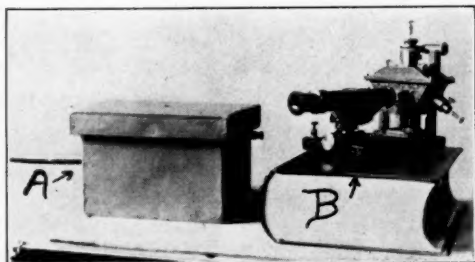


Figure 1

- (a) Ionization chamber built in our laboratory for the measurement of intensity.
- (b) Electroscope used for measuring output of ionization chamber.

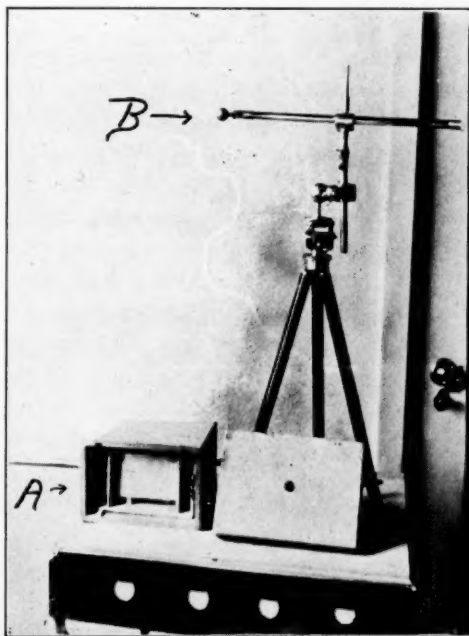


Figure 2

- (a) Ionization chamber (with lid removed) as shown in Figure 1.
- (b) Sphere ionization chamber against which "a" was checked.

First, the x-ray apparatus must be accurately calibrated as regards intensity; the voltage should be accurately determined, but a variation of one kilovolt may be permissible.

Second, the thickness of the part being examined must be accurately determined, and the selective wave length obtained for the thickness under consideration.

CALIBRATION

The actual voltage of an x-ray machine may be determined by spectrometer, or sphere gap volt meter.* The spectrometric method is to be preferred. However, with a calibrated sphere gap voltmeter, the operator can, with care, calculate the voltage to within one kilovolt. This will, perhaps, suffice for practical purposes. To obtain the wave length after the voltage has been ascertained by either of the above methods, the following formulas are used:

$$\begin{aligned} \text{K. V. equals } & \frac{12,400}{\text{Wave length}}; \text{ or,} \\ \text{Wave length equals } & \frac{12,400}{\text{K. V.}} \end{aligned}$$

Calculations employing the above formulas will be fairly constant, and will furnish a wave length, or K. V. value which is later to be added to the "thickness chart."

The measurement of the intensity of x-rays is most important. The roentgenographer must know the energy distribution in the x-ray spectrum and must have a ready and accurate method of measurement of the absolute intensity if he hopes to obtain the very best x-ray negatives. Intensity is measured, not as radiation energy directly, but by means of the effects which it produces, namely, heat, ionization, photographic "density," fluorescence, color changes, and changes in conductivity

For the measurement of the absolute intensity, instruments depending upon heat are the best, although in the average x-ray laboratory ionization methods are employed (if any method is used at all). For the measurement of

intensity for roentgen therapeutic purposes many excellent and accurate ionization instruments have been developed. Any of these good types of ionization devices may be applied to the measurements of intensity for roentgenography.

Since the technician, in most instances, will have to work out this technic for himself, we shall endeavor to make it as practical as possible. No units of any type will be employed, and the unskilled technician can figure out for his particular laboratory any chart desired without any difficult mathematics.

APPARATUS

Any good ionization chamber with some suitable instrument for measuring the output of the chamber is all that is required. In our own work a very fine grade of gold leaf electroscope was used. (See Figure 1.) The ionization chamber was built by one of us (W) in the laboratory and standardized with radium; it was also checked against an excellent, and very accurate sphere ionization chamber** (See Figure 2), and the discharge time of the electroscope was found to be identical for both chambers.

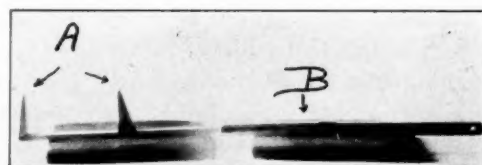


Figure 3

Device for measuring thickness of extremities in inches.

A simple ionization chamber can be built in a few hours by anyone who is mechanically inclined. It consists simply of a series of aluminum sheets about 5 cm. long and 2 cm. broad held parallel to each other and 5 mm. apart by hard rubber frames.

A very good electroscope can be built as easily as the ionization chamber described in the above paragraph. (We shall be glad to furnish

*The Sphere Gap Voltmeter, Archives Physical Therapy, X-Ray, and Radium, March, 1929. R. A. Watters.

**The Sphere Ionization Chamber shown in Figure II, was built by Mr. V. B. Seitz, Physics Department, Crile Clinic, Cleveland, Ohio. It has proven to be an unusually fine instrument.

a description of these devices if enough readers will write us indicating their desires.)

To calibrate an x-ray machine in this manner for long wave roentgenography the following rules are observed:

1. Select a standard. This is done by securing a film of exactly the right density and contrast. Take a hand, for instance: this is the best with which to begin. Measure the hand and record its thickness. It will probably measure $1\frac{1}{2}$ inches, if it is an average hand. Set the x-ray machine for 28.8 K. V. and 10 M. A. (We will assume that you have already measured the voltage with spectrometer or sphere gap voltmeter.) Set the tube at exactly 24 inches from the film (in cassette with double intensifying screens). If a 10 by 12 film is used three exposures can be made before the negative is developed: Give as time of exposure: No. 1, six seconds; No. 2, seven seconds; No. 3, ten seconds; each exposure is timed, of course, with a stop watch. Develop the negative; if one of the three exposures proves satisfactory, that one will be the standard. If they are not satisfactory, the operator will be in position to tell which is under-exposed or vice versa, and the effort can be repeated.

For the purpose of illustration, we will assume that the exposure having ten seconds is satisfactory. We know now that all hands, or anything else measuring $1\frac{1}{2}$ inches, if given the same time, voltage and milliamperes, at twenty-four inches, will give the same result.

Our standard thus obtained proves that we have used the right voltage (or wave length, which is, in this instance, $.043\lambda$), and just enough x-rays have reached the film to produce the desired photographic effect. The negative is not "over-penetrated," over, or under-exposed, and we have a "picture" clear, distinct, contrasty, and full of rich detail.

2. Our standard now assumes the following proportions: Hand, $1\frac{1}{2}$ inches thick; 28.8 K. V., 10 M. A., 24 in. dist., and 10 seconds exposure time.

CHART NO. 1

	Thickness, Inches	λ	K. V.	Dist.	Volts, Pre- Reading	Time, Sec.	M. A.
Fingers, Hands and Wrists	1	.043	28.8	24	65	8	10
	$1\frac{1}{4}$	.043	28.8	24	65	10	10
	$1\frac{1}{2}$	.043	28.8	24	65	12	10
	$1\frac{3}{4}$	.043	28.8	24	65	16	10
	2	.037	33.5	24	74	8	10
Forearm, Elbow, Ankle, Etc.	$2\frac{1}{4}$	.037	33.5	24	74	12	10
	$2\frac{1}{2}$	.037	33.5	24	74	14	10
	$2\frac{3}{4}$	.037	33.5	24	74	16	10
	3	.032	38.9	24	85	8	10
Knee, Shoulder, Etc.	$3\frac{1}{4}$	.032	38.9	24	85	10	10
	$3\frac{1}{2}$	.032	38.9	24	85	12	10
	$3\frac{3}{4}$	.032	38.9	24	85	14	10
	4	.029	42.5	24	95	5	10
	$4\frac{1}{4}$	.029	42.5	24	95	8	10
	$4\frac{1}{2}$	.....	.....	24	.....	.....	10
	$4\frac{3}{4}$	.....	.....	24	.....	.....	10
	5	.....	.....	24	.....	.....	10
	$5\frac{1}{4}$	.....	.....	24	.....	.....	10
	$5\frac{1}{2}$	.....	.....	24	.....	.....	10

The ionization chamber is now placed under the x-ray tube at exactly 24 inches from the target. A small cone is used to restrict the size of the field, the one mm. filter is placed in its holder, and the ionization apparatus is tested. When our instruments are working correctly, we then proceed with the calibration.

A glass (thin) container, or a bakelite tank of the proper proportions is placed over the ionization chamber in as close proximity as possible. The container is filled with water to a depth equaling the thickness of the hand used in the standard. (In the example it was $1\frac{1}{2}$ inches.) Now, with $1\frac{1}{2}$ inches of water in the container, an exposure of ten seconds is made.

During the time that the exposure is being made with the water, the fall of the leaf in the electroscope is timed between selected divisions for a period of ten seconds. The operation should be repeated several times to be sure that the leaf drop is constant. For practical purposes "natural leak" does not have to be taken into

CHART NO. 2

Thickness Part Inches	λ	K. V.	Time, Sec.	M. A.	Dist.	Double Screens
1	.043	28.8	.....	20	24	Required
1¼	.043	28.8	.....	20	24	"
1½	.043	28.8	.....	20	24	"
1¾	.043	28.8	.....	20	24	"
2	.041	30.2	.....	20	24	"
2¼	.041	30.2	.....	20	24	"
2½	.039	31.8	.....	20	24	"
2¾	.039	31.8	.....	20	24	"
3	.036	34.4	.....	20	24	"
3¼	.036	34.4	.....	20	24	"
3½	.034	36.5	.....	20	24	"
3¾	.034	36.5	.....	20	24	"
4	.033	37.8	.....	20	24	"
4¼	.033	37.8	.....	20	24	"
4½	.032	38.9	.....	20	24	"
4¾	.031	40.0	.....	20	24	"
5	.030	41.5	.....	20	24	"
5¼	.030	41.5	.....	20	24	"
5½	.030	41.5	.....	20	24	"
5¾	.029	42.5	.....	20	24	"
6	.028	44.5	.....	20	24	"
6¼	.028	44.5	.....	20	24	"
6½	.028	44.5	.....	20	24	"
6¾	.027	46.0	.....	20	24	"
7	.026	47.5	.....	20	24	"
7¼	.026	47.5	.....	20	24	"
7½	.026	47.5	.....	20	24	"
7¾	.026	47.5	.....	20	24	"
8	.025	49.5	.....	20	24	"
8¼	.025	49.5	.....	20	24	"
8½	.025	49.5	.....	20	24	"
8¾	.024	51.5	.....	20	24	"
9	.023	54.0	.....	20	24	"
9¼	.023	54.0	.....	20	24	"
9½	.023	54.0	.....	20	24	"
9¾	.023	54.0	.....	20	24	"
10	.022	56.5	.....	20	24	"
10¼	.022	56.5	.....	20	24	"
10½	.022	56.5	.....	20	24	"
10¾	.022	56.5	.....	20	24	"
11	.021	59.0	.....	20	24	"
12	.021	59.0	.....	20	24	"

consideration. Suppose the leaf drop during ten seconds is four divisions on the scale. This means that for 1½ inches of tissue (or the standard) that a drop of four divisions represents the intensity required on the film surface to produce the perfect negative. In other words, four divisions represent the exact amount of "light" necessary to produce a desired photographic effect.

Since just enough "light" should reach the film to impress an image of the media on the bromide of silver, we can now assume that for the ionization standard four divisions on the scale are correct. Water and animal tissue have very nearly the same coefficient of absorption. The leaf drop on the scale of the electroscope will apply to both media.

Our ionization standard now becomes: Water, 1½ inches, 28.8 K. V., 10 M. A., 24 in. dist., and 10 seconds exposure time, which equals a leaf drop of four divisions on the scale in 10 seconds.

It follows, therefore, that when the proper wave length is used for a given thickness, the time required for the leaf in the electroscope to drop four divisions on the scale is the *correct* exposure time for that thickness.

3. Let us take another example: Our receptacle now contains four inches of water, which is equivalent, let us say, to a knee of the same thickness. By referring to our "wave length chart," (See Chart No. 2) we find that for four inches of tissue a wave length of .029 is required, that is, 42.5 K. V. Obtaining the specified voltage, and keeping constant the distance, and milliamperes, we observe the time required for the leaf in the electroscope to drop four divisions on the scale. In this instance, it will take five seconds. Therefore, for four inches of tissue, at 42.5 K. V., and 10 M.A., at 24 inches target distance, five seconds exposure time is required.

In this manner a correct exposure time can be charted for every inch, or fraction of an inch, of tissue thickness.

Chart No. 1 illustrates the type of "chart" made for one of the machines in our laboratory for extremities and their thickness. Similar charts can be made for any type of machine; and this one is included to serve as a model for those who have not had much experience in charting x-ray machines.

Chart No. 2 represents selective wave lengths. This chart furnishes thickness of tissue

up to 30 c.m., (10 inches). Selective wave length, kilo-voltage equivalent, and an arbitrary milliamperage setting of 20 M. A. The distance, which is 24 inches from target to film, should be kept constant. The "Time" space is left blank. This can be filled in for the individual machine. If operators not having intensity measuring instruments desire to calibrate their apparatus for long wave technic by the "trial and error" method, they will find it a pretty expensive proposition. It is better, however, to make such a calibration, even though it is tedious and expensive, than not to do it at all. The quality of the negatives thus obtained makes this type of technic very desirable.

PRACTICABILITY OF LONG WAVE TECHNIC

Long wave technic is practical. We began the development of this system in our laboratories about one year ago. During this time one of us (W.) has given several laboratories the "idea" for a workout. Two in Los Angeles, Calif.; one in the middle west; and one in the east. In all instances those who have put long wave technic into practice have been well repaid for their efforts.

CONCLUSION

1. Long wave technic indicates the employment of the very softest x-rays possible for practical roentgen examination of the human body.

2. Long wave technic is based on the supposition that each fraction of an inch of tissue has a variable absorption coefficient, and for the increased thickness a selective wave length is employed that the exact amount of penetration may be obtained.

3. Long wave technic is based on the supposition that just enough intensity of x-rays should reach the film to produce a definite photographic effect.

4. Intensity varies with voltage and current. It is intended that by keeping voltage and

current regulated for all densities of the media that the intensity will be kept constant.

5. X-ray machines should be accurately calibrated for voltage and intensity before long wave technic is attempted.

6. Calibration of x-ray machines is made with spectrometer, or sphere gap voltmeter, to determine wave length, and K. V.; with ionization apparatus to determine x-ray intensity.

7. Calibration for roentgenographic intensity is accomplished first, by obtaining a photographic standard; water, in depth, equaling tissue in thickness, produces equal intensity at the same kilovoltage, milliamperes, and target distance. (The target should not be allowed to become too hot, as it will make some difference in the practical application of these intensity measurements to photographic films.) Ionization time for various depths of water, using the correct K. V. for the thickness used, equals the exposure time for tissue.

8. Long wave technic is practicable.

- A. It has been used by us for about one year, and has been entirely satisfactory.
- B. Others using long wave technic find it both practicable and satisfactory.
- C. Extremities show contrast and detail equal to that done by Bucky diaphragm.
- D. Skulls and sinuses made with long wave are equivalent, and in many instances the delicacy of the photographic effect surpasses Buckey diaphragm work.
- E. Spines and pelvises can be made by long wave which will equal Buckey work.
- F. Results can always be duplicated.
- G. Every film is a "show film."
- H. Any number of "parts" can be put on the same film, each showing the same density and contrast.

PROSTATITIS—TREATMENT BY DIATHERMY*

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The therapy of infected prostate is as old as it is protean, and the scanning of current literature does not convince that any specific is either at hand or in the near future. Always it must be kept in mind that the prostate is a racemose gland with a comparatively few ducts which empty into the urethra and that these few drain a vast system of smaller and shorter ducts which number increases by more than geometrical progression as they grow inversely smaller and more difficult to empty. The picture is that of many very small and almost stagnant ponds and pools where the current is either stationary or extremely sluggish, that are drained by tiny creeks or marshes which in turn are drained by larger and more freely moving currents. It is in the small foci in terminal small tubules that the infection persists so long and that is so difficult to empty. It is questionable if the larger tubules ever present enough infection that is not adequately taken care of by drainage. Their caliber is so large that they are never effectively stopped by debris and they can not then become a nidus for infection. It is infection that is retained in a small space, under some amount of pressure, that promotes absorption that causes rapid and constant dissemination of infecting organisms to distant points.

Prostatitis is most commonly a sequel to gonorrhea, but not so universal as to condemn the innocent patient. Many cases of prostatitis due to colon and staphylococcus have never been preceded by the Neisserian organism. It is rare to find diplococci in the chronic form of prostatitis, though in most cases it has been there at one time.

The pathology of prostatitis varies from fulminating abscess to a slightly tender prostate noticed on rectal examination. With the abscess we are not concerned, its treatment is surgical.

With acute infectious prostatitis the palpating rectal finger finds a boggy, enlarged, tender mass from which purulent secretion is expressed by gentle massage. This occurs in any period of a gonorrheal infection or may follow any acute infectious process elsewhere in the body. Whether prostatitis is an hematogenous infection or one brought on through contiguity of structure is not revelant to its treatment as the pathology is the same, the only importance being the necessity of eradicating other foci.

The subacute or chronic form of prostatitis is a very different type of disease from the two foregoing. Here the prostate has been invaded a long time previously and is more or less saturated with the products of chronic irritation. Only enough secretion may be escaping to cloud the first urine as it is passed in a two glass test, or to glue together the lips of the meatus. This type of prostatitis is the common cause for that universal complaint "gleet" or the "morning drop." Here the infection has settled down into the smaller alveoli and the less viable Neisserian organisms chiefly disappeared and colon and staph predominate. It must be borne in mind, however, that gonococci have been known to live in the prostate for a period of three to five years.

The last type of prostatitis is not characterized by any physical signs but rather vague symptoms. These are aching joints, neuritis, neuralgia of muscles and malaise, in other words, general manifestation of a specific focus of infection. This type of thing we see often as a result of diseased tonsils or abscessed teeth. Many of these cases fail to show any of the ordinarily looked for foci as the teeth and tonsils and are sent to urologists for prostatic examination. The urines are clear and the prostate only slightly tender and secretion may show one or two pus cells to a field. On the ordinary inspection there is no focus of infection in this prostate but our repeated experience has been a

*Read at the seventh annual meeting, American College of Physical Therapy, Chicago, Oct. 10, 1928.

very interesting one to us. Where we suspect these individuals of harboring prostatic infection and this suspicion is aroused chiefly by joint pains and neuritis, where no other focus of infection is found, a sense of fulness and indefinite discomfort in the perineum is a common concomitant. In these cases we never pass an instrument nor irrigate the urethra until we have tried for at least two weeks the effect of rectal diathermy on the prostate. The reason we exclude all intraurethral manipulation is that we wish to be sure that no infection is introduced from without to confuse the prostatic picture. We have had a large number of such cases referred to us presenting symptoms of arthritis with clear urine, negative prostatic secretion. We have given them rectal diathermy at intervals of two to three days, the current about 750 to 1500 milliamperes for twenty minutes. This is followed by prostatic massage. That heat is communicated to the prostate by diathermy no one can doubt who massages the prostate immediately following treatment. After two or three massages the patient usually becomes much worse from a general standpoint, the joints are tenderer, the neuritis much worse. The prostatic secretion that is massaged out changes from a practically clear viscous fluid to a much thinner one of a whitish color, containing an increasing number of white corpuscles. When the flow from the prostate becomes free and there is a definite purulent secretion, the distant symptoms rapidly subside and the patient is in many cases almost transformed. The average number of treatments in these cases varies a little but the patients are much worse after the second or third, usually about as bad as when they came in after the fifth or sixth, and then they improve very rapidly. I do not think that diathermy has any specificity other than as a heat producer in this type of case, but I do believe it to be the most efficient method of introducing heat into the prostate yet devised.

In a short time this latent prostatitis becomes the chronic form and we have found diathermy of value in inverse proportion to the amount of pus in the massaged secretion. Before drainage is established, where the alveoli and small acini are clogged with stagnant pus flakes,

then the heat dilates them and promotes the flow. After a good flow is established we have not found diathermy of advantage.

Only two points have come to our attention to contra-indicate diathermy. One is the possibility of burn, or injury to rectal tissue. We have never seen incidence of this though we are always extremely careful in manipulating these cases. We use no rectal thermometer, believing that the patient's sensation is sufficient guide and alarm. The other point is, does diathermic heat in the prostate increase the likelihood of epididymitis? We have thought that it did in subacute prostatitis though only the ordinary clinical observation substantiates us.

Our chief contribution is the realization that patients with hidden foci of infection may show only very slight or no signs of prostatic involvement in the urine or prostatic secretion, yet with their aching joints and neuralgia is a sense of fulness in the perineum and inguinal discomfort. These patients after treatment by diathermy express increasing amounts of pus from the prostate, the remote symptoms of infection are temporarily aggravated and then as the flow of pus increases the symptoms improve.

The ordinary forms of prostatitis are as well treated without diathermy as with it after the flow through the ducts has begun.

In acute cases diathermy is undoubtedly dangerous.

DISCUSSION

DR. FRANK H. WALKE (Shreveport, Louisiana): When I was first interested in diathermy to the prostate, it was brought about by the number of so-called focal infections and conditions arising from the prostate that added insult to injury about a joint. We would get a joint injury, or some other injury, and we knew that it was prolonged beyond the necessary recovery time. Then we would have to treat a focal infection. Now I examine the teeth and the tonsils and go direct to the prostate in these individuals, because nine times out of ten, or a larger percentage than that, give a history of having had gonorrhea at some particular time. If the prostate is treated, those cases will clear up in a very short while.

I have never made any reference to the condition other than to look for a result. That is, I do not classify them pathologically as to acute, subacute, fibroid, or whatever you want to term them, but necessarily as places of focal infection.

There are several tricks in applying diathermy to the prostate. You can't take any one method of application. The question is whether or not an electrode in the rectum and one on the abdomen is sufficient for all cases. I think not. I am inclined to believe now in those cases of focal infection that I want a fairly large rectal electrode. Then I use a six-inch belt around the abdomen, the rectum being the hub, the current going out to the indifferent electrode in all directions, and those cases which present arthritides or some particular pain in the back are best benefited by that particular feature.

If we have another condition that does not yield to that, I give treatment with a large electrode in the rectum and have my patient lying on the autocondensation pad. I concentrate the heat in the rectum, and disseminate the current through the body. If there is anything in the bone marrow, or endothelial cells, we get that effect as well as locally.

In those particular cases I always follow the treatment of diathermy by about three to five minutes of a sine current, not a contractile current, but one that is constant. I used to use the contractile current, thinking that I could get something in the way of massage, but I give the straight sine current from three to five minutes following the diathermy. After that I massage the patient and get a large quantity of pus and fluid from the prostate.

Massaging the prostate is one of the things which, if not done properly, gives no results.

I think the reason epididymitis cases sometimes follow diathermy is that the seminal vesicle is not emptied and it has a tendency to cause an inflammatory condition by blockage.

DR. JOHN R. CAULK (St. Louis, Missouri): I have been using diathermy for a year or two quite considerably in prostatic inflammations and at the present time do not know exactly how I stand on it.

In fact, I have not analyzed the cases. Mine is purely an impression. I felt that diathermy has really a very definite application in acute prostatitis; I don't mean the abscess, but the large swollen prostate. We have seen very definite shrinking and rapid abatement of symptoms following the rectal application of diathermy. I have used it very little in chronic infections. It is mostly the subacute and the acute that I have been applying it to, and I have never witnessed any harmful results.

Dr. Grant discriminated definitely between the prostatitis of the young and middle-aged man and the hyperplasias, the hypertrophies, the adenomas of the aged individual. I personally think one is the end result of the other, and I hope to be able to convince you somewhat that that is a fact. I believe that the majority of prostatic hypertrophies are old neglected hyperplastic changes throughout these acini and tubules, as he illustrated, and that one is, as previously stated, the end result of the other.

Clinically, one serious thing about the detection of chronic inflammatory lesions of the prostate and vesicles, is the fact that their symptoms are so vague. Unless a man has a prostatic inflammation accompanying acute gonorrheal infection, the general practitioner of medicine is seldom awakened to the fact that there is any trouble in the prostate and vesicles.

The average man may not be even suspicious of prostate. In the suspicious cases, the physician will make a rectal examination and will find a small apparently soft prostate, and say that the prostate is normal. My experience has been that these types that feel so normal are the ones that are full of pus and much more likely to be causing general systemic reactions, particularly the joint manifestations. One word of warning would be for a careful rectal examination, plus an expression of secretion, as Dr. Grant says. Analyze the secretion, analyze it repeatedly, analyze it after diathermy. Get these chronic things to empty themselves, soften up their exits so that they will empty their contents.

DR. OWSLEY GRANT (Louisville, Kentucky): Dr. Walke has brought out a point that I think is important; that is that the seminal vesicles must be emptied at the same time. We have so long associated the prostate with the seminal vesicles that in massage we practically consider them all one; the prostate being emptied without the seminal vesicles, is of course, a useless procedure. In fact, the condition of the seminal vesicles has gone to such stages at times when they could not be properly emptied as to justify their surgical removal. It is extremely interesting to hear Dr. Walke say that these patients with whom he has to do in industrial surgery present the type of prostate that we do feel is the type of thing that keeps the hidden and long contained foci, the small prostate. This prostate, while it is hard and small, in our experience has nearly always been moderately tender upon massage, not tender like the acute prostate, but with enough massage to express real secretion.

This, connected with indefinite pains and pains in the perineum, I think thoroughly warrant a week or two exploration with diathermy in order to be sure that the prostate is or is not the focus of infection, which is causing the distant signs.

ULTRAVIOLET IRRADIATIONS IN HYPEREMESIS GRAVIDARUM*

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Hyperemesis gravidarum occurs in over 50 per cent of all pregnancies among the civilized peoples of the earth, the cases ranging in severity from the very mild to the pernicious form. America has a pernicious case in every 3,000 or 4,000 pregnancies, while England and Germany boast of only one in a thousand of hospital cases.

The symptoms of nausea and vomiting in pregnancy can be traced to the time of Hypocrates, but it was left for Soranus of Ephesus, twenty years A. D., to emphasize the condition as a disease entity.

Delmore, in the nineteenth century, called attention to the dangers associated with hyperemesis gravidarum.

Simond, in 1813, was the first physician to successfully interrupt pregnancy as a therapeutic measure. Paul DuBois, in 1852, presented a thesis on hyperemesis before the French Academy of Medicine, which is still a classic. DuBois arbitrarily made three classifications of the disease. DeLee, today, etiologically, recognizes four types: reflex, toxic, neurotic, and those due to abnormal blood conditions. J. W. Williams and others simplify matters by putting all cases of nausea and vomiting of pregnancy into one of two classes: toxic or neurotic. Such a classification is more practical clinically, since the line of demarkation between cases is only of theoretical value, and the problem still remains unsolved, as to why one gravid woman vomits and the other does not.

For convenience and simplicity let us classify all cases of nausea and vomiting of pregnancy under one head, hyperemesis gravidarum.

That the pregnant woman must vomit is the theory accepted by many physicians and by

most of the laity. Indifference to hyperemesis, taking it as a natural consequence of gestation, has lead to many unfortunate and distressingly serious complications. It is said that Charlotte Bronte died of the disease. Few of us have to search far to find such instances.

As a basis for considering this disease of the gravid state, the nausea and vomiting of pregnancy should never be looked upon as a purely physiologic condition, but should be treated as pathology from its inception.

Calkins believes that the condition is due to a protein intoxication. Bourne, of Great Britain, contends that a toxine is constantly produced by the growing ovum, and that its absorption results in the poisoning of the mother. Schmall has definitely proved that a foreign foetal protoplasm is conveyed into the maternal circulation. Schmall agrees with Bourne that a biologic defense is set up by the maternal tissue, to overcome this invasion. Abderhalden demonstrated that maternal blood contained a specific ferment capable of digesting placental proteide. Lackerman proved the sensitization of maternal serum to that of the foetus, and also to that of the placenta.

Veit also demonstrated that ectoderm and fragments of chronic villa are constantly becoming separated from the placenta and gain access to the maternal circulation, consequently, if the quantity is too great to be neutralized, toxemia results. Udaeta, the Spanish obstetrix, believes that the toxemias of pregnancy are caused by the products of gestation, the toxemia being due to the characteristic complex of the albumin molecule in the various individuals, and to substantiate this claim, cites the reaction following blood transfusions. Udaeta assumes that the foetus acquires the father's characteristic albumin. Following out this theory, he reports five cases in which he obtained astounding re-

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sults by injecting the whole blood of the father to desensitize the mother.

W. S. Horn of the Harris Clinic, Fort Worth, Texas, reports the following in the Texas Medical Journal of July, 1925: April 4, 1924, a patient was referred to the Harris Clinic for a therapeutic abortion. Instead, following out Udaeta's theory, 1 c.c. of the father's whole blood was injected subcutaneously. Twenty-four hours later 5 c.c. was injected. Twenty-four hours later another 5 c.c. was injected. At the end of forty-eight hours the patient was completely relieved, and two months later was delivered of a healthy child. A blood typing was done; that of the mother typed three, while the blood of both father and child typed two. Following out this theory, Horn tabulated 65 cases. In 25 of these cases there was no vomiting during pregnancy; in each case mother and child typed the same. The other 40 cases had hyperemesis; in each case blood typing was done, mother and child typed differently.

According to Stowe, Ewing, Titus and others, a carbohydrate deficiency is placed as the most predominant factor in producing the pernicious form of hyperemesis.

Physiologically, the liver is the storehouse of glycogen, and is the great detoxicating organ of the body. The liver develops necrotic spots when depleted of glycogen, as in case of death from starvation. All those patients who die as a result of pernicious vomiting show these necrotic areas. Even animals in which the liver glycogen is lowered are unable to withstand any form of intoxication, due to the lowering of the detoxicating function of the liver.

After a meal the liver is 10 per cent glycogen by weight. The adult muscle is 10 per cent glycogen, while that of the foetus is 40 per cent. To meet this foetal demand there is an immediate call on the pregnant woman for an excess of calcium and glycogen, particularly glycogen. This sudden call for glycogen, together with a reduced intake caused by hyperemesis, readily produces a vicious circle, and clinically it makes very little difference whether the

cause is neurotic or toxic, it results in pernicious vomiting.

G. C. Hurst and Philip Carter, together with some English authorities, attribute all the trouble to an endocrine unbalance, and administer corpus luteum and ovarian extract, with that end in view.

Research work with the resulting theories place in discard all but the most universally accepted theories and their consequent treatment.

Hospitalization for the severe cases, bromides and suggestions; proper diet; glucose and saline solution to replace the lost fluids and glycogen; all are being used by the obstetrician of today. The results of these treatments are good, but those of us who have added to our therapeutics—physical agencies, have by virtue of biologic action of the ultraviolet light, opened an avenue that offers great possibilities.

Four years ago our clinic began the use of ultraviolet irradiations in nausea and vomiting of pregnancy. Gradually ultraviolet radiation has come to be the thing around which we center our treatment of hyperemesis and associate conditions.

We could select for you a dozen or fifteen very interesting cases treated during that period of time; all of these except one very neurotic woman responded quite satisfactorily to ultraviolet irradiations.

The two following case reports, one a blonde patient, the other a brunete, have been selected for the purpose of illustration, and with the hope that they may suggest to you the possibilities of ultraviolet irradiations in hyperemesis gravidarum.

CASE ONE

A young woman, age 31, blonde, good family history and normally healthy until she acquired a specific infection. An acute pelvic abscess was suprapubically drained. She had a very difficult time, but recovered, with abdominal adhesions and extreme constipation. She later married, and I was called November 11, 1922; she was suffer-

ing from abdominal distress and hyperemesis. I was called again on December 12, 1922. I found very little change; discomfort and hyperemesis were still very distressing.

February 26, 1923, I found this patient aborting; she was removed to the hospital and made an uneventful recovery.

May 3, 1926, this patient again came under my care. She was three months pregnant and had been in bed most of the third month. Ptyalism was pronounced and distressing; vomiting constant, producing weakness and prostration.

May 4th she was hospitalized; 30 grains of sodium bromide was given rectally every four hours for eight doses; hot water was given by mouth, and she was given ultraviolet irradiations every day. By the fourth day she was completely relieved and on a general diet. On the seventh day she was dismissed from the hospital. She returned on the 13th, 15th and 19th days of May for ultraviolet irradiations. There was no more trouble during her pregnancy, and on November 26th, she was delivered of a healthy child.

CASE TWO

July 21, 1928, a young, well-nourished, hard-working brunette came to the office. She was pregnant two months and her second pregnancy. She said she must have some relief, as she had vomited constantly for three weeks, even after supper, and that she had lost ten pounds during that time.

She was told that the ultraviolet light would give relief. A total body irradiation was given, two minutes each, on four surfaces, at 36-inch distance. She was requested to return the next day if there was no skin irritation. This she did, stating that she was improved; the same treatment was repeated, and forty-eight hours later she returned, stating that she would not have to take any more treatments, as she was completely relieved after the last exposure. The previous morning she had prepared her husband's breakfast and had eaten with him without any trouble following. I gave her three minutes exposure on each of four surfaces, and told her that she would remain well if she kept her bowels regular and was reasonably careful of her diet. She was requested to return if there was any recurrence of her trouble.

For the purpose of giving a rational reason for the title of this paper, I have sought information regarding hyperemesis among other than the civilized races. This information regarding hyperemesis among savage and semi-civilized tribes has been very hard to get. The Iowa State Library, the A. M. A. Library, and the Army and Navy Library at Washington, D. C., were unable to give me anything of value. However, this lack of available information, together with the extracts from the following letters, would lead us to believe that hyperemesis gravidarum of any degree of severity is a resulting condition of civilized life.

W. F. Prior Co., Inc., of Queens Hospital, Honolulu, July 25, 1928.

After a very careful search of the literature, our researchers are unable to find a single reference to the vomiting of pregnancy among the women of the savage and semi-civilized tribes.

Nils P. Larson, M. D., Medical Director, Queens Hospital, Honolulu, says:

Unfortunately, Honolulu has become an American playground and savage tribes have disappeared. The mixing with white blood has removed all traces of semi-barbarism. I am sorry I cannot give accurate data as to results in races, but my impression is that the percentage of pernicious cases are about the same. All have been under the torch of European training for a hundred years.

J. B. McCord, M. D., 86 Beatrice street, Durban, Natal, South Africa, says:

While Zulu women have plenty of trouble in child bearing, hyperemesis does not seem to be one of them. They are stoical, their food is simple, and they get very little sympathy. They often complain of digestive discomfort and some vomiting at that time, but in my twenty-eight years among the Zulus, I do not remember of having seen a severe case of hyperemesis gravidarum.

In compiling the information gleaned from our medical literature, one is impressed with the thought that hyperemesis gravidarum in its se-

vere form is one of the results of the abnormal environment of civilization, through the loss of the normal biologic ultraviolet irradiations.

In each case of vomiting of pregnancy, we have a toxic or neurotic element, either or both, and without question, the most serious feature in each case is a carbohydrate deficiency with its resulting complications.

In view of our present knowledge, may we not justly credit the ultraviolet light with biologically placing the human organism in a condition to more rapidly assimilate that which is required to meet the extreme physiologic activity that comes with pregnancy, and place our civilized woman, physically, on a par with her Zulu sister, thus practically eliminating the distressing condition, hyperemesis gravidarum.

DISCUSSION

DR. E. T. DICKINSON (Wilson, North Carolina): I am not an obstetrician. I have had a hospital practice some twenty years, and I think I may have independently discovered the beneficial effect of Finsen light on hyperemesis gravidarum. However, I don't wish to take any credit whatever for it. On one occasion, a doctor sent in such a patient when I was very busy with some other work, requesting that immediate operation be done, that he had tried all medical temporizing measures that could be possibly beneficial. For the reasons mentioned, I had to delay the operation for a while, so to tide over the emergency, I asked that a Finsen light be applied to the patient for the sake of psychotherapy. To my surprise, I was put in a very embarrassing position: the woman ceased to vomit, although she had vomited incessantly every minute for several days. She made a perfectly smooth recovery; in fact, the recovery was that day.

I had no theory for it, but since then I have never let a case of hyperemesis gravidarum get away from me without applying the Finsen light. While the success in most cases has not been as spectacular as it was in that case, I have scarcely ever failed to get satisfactory benefit from the use of the light.

DR. FRANK H. WALKE (Shreveport, Louisiana): I recall only two cases in my own practice since I have given up obstetrics, in regard to hyperemesis gravidarum. Several years ago I began studying calcium deficiencies in individuals, and I came to the conclusion that this condition could be classed with calcium deficiencies. I began to feed these cases calcium and applied ultraviolet light.

In the two cases that I tried it on, the condition cleared up happily and they went on. It was not original with me; I saw someone else try it at a meeting or somewhere. A doctor, I think at Kansas City, spoke of some of the toxemias of pregnancy being due to calcium deficiency. I began to give calcium and augmented it by the use of the ultraviolet. I had good results in the two cases, but I have not had any since to try it on.

DR. L. A. TARBELL (Battle Creek, Michigan): I am afraid I cannot shed much light on the subject. I recall just one case which had psoriasis and it was recommended that that woman take ultraviolet. She was also given corpus luteum and other medication. She had four treatments of ultraviolet and the vomiting stopped. Just what it was due to, I cannot say. I think this is a very interesting subject, and I hope that further experimentations along this line will give us more definite information to add to the literature on the condition.

DR. H. D. HOLMAN (Closing): I had more cases to recite, and I happen to be one of several in a partnership in a clinic, and the others suggested that I cut the number of cases down very close, so I gave just two. I gave two extremes, one blonde patient and one a brunette.

When the second woman came into the office, the girl who has been working with me knew that I was writing the paper and when I told her to take the patient in and give a treatment, I said, "This is the one treatment that we are going to use as an illustration in the paper." I said that before the patient had received any treatment. It happily turned out just as I had expected, and I used it as an illustration.

I haven't any idea why we get these results. I know it is used in a lot of cases before surgical operations, and if you irradiate your patients a few times, they won't vomit as much afterward. I know in a few instances where we have a gastric crisis in a tabes dorsalis and get excessive vomiting, the ultraviolet will make it clear up as nothing else will do.

I was wondering if it had an influence on the sympathetic or had something to do with the calcium. Dr. Kime, several years ago, in talking about calcium and potassium metabolism, said that the blood test did not amount to anything, that you wanted to get it out of the spinal fluid, because the blood was bound to take it. We have an excessive call for calcium. I am wondering whether it is possible that there might be a calcium deficiency that was immediately corrected. It would seem hardly possible that there would be calcium enough to make the difference that quickly. We who live in rooms like this without sunlight are not in position to get the ordinary amount of calcium that we need to make the cellular metabolism result as it ought to do.

Anyway, after looking up all the literature that I could get, and I cited only two or three instances where I tried to get information, it was very difficult to get any further information on the subject, except what referred to civilized people. It seemed to me that in the use of the ultraviolet light we could check the vomiting, and thus prevent tissue starvation and glycogen depletion.

In the number of cases over the period of time that we have been using it, every case has favorably

responded. The woman whom I said was nervous and did not get along was an extremely neurotic individual and one that you could not do very much with. She did not come and take the treatments that she should have taken. If she had, I think she would have gotten better results.

We use that treatment whether there is much vomiting or not. Beneficial results are always produced. I believe that calcium metabolism must have something to do with it.

PHYSICAL THERAPY CLINICS

ELECTROSURGERY*

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Successful surgery requires sufficient ablation of pathological tissue to permit of the greatest degree of restoration of physiologic function. Cosmetic appearance, operative or postoperative discomfort and economic factors while important are of secondary consideration in the treatment of accessible neoplastic and infectious granuloma. Fortunately in electrosurgery not only the above mentioned major premises are fulfilled but also those minor ones dealing with the extent and nature of the scar, after pain and disability. While it is a mistake to attempt to adopt as an office procedure major operations such as resection of large areas of human tissue, still it is possible to satisfactorily perform many operations upon the face, nose, ear, cheek and within the oral cavity which by ordinary surgical technic could be safely carried out only in a hospital. Moreover, in graver conditions, such as amputation of breast, lip, tongue, or resection of portions of the mandible, maxilla or cranium for malignancy, and in the surgical ablation of carbuncle, condylomata and other granulomata, the convalescence after skillful electrosurgery is usually prompt and uneventful.

Modern electrosurgery requires the following prerequisites:

1. A thorough basic training in the many medical and surgical arts and science; accurate diagnosis and good surgical judgment.
2. A complete understanding of the physiodynamics of both the damped and undamped high frequency currents; of the proper technic of electrodesiccation, electrocoagulation and electrothermic excision; and of the adjuvant relationship involved in the preliminary or post-operative exhibition of one or other of the various agencies which belong to the electromagnetic spectrum, namely, x-ray, radium, ultraviolet radiation.

The experience of the essayist has been limited to the removal of superficial neoplasms and granulomas of the parietes, and of accessible cavities such as the oral, and nasal cavity, and of the rectum and vagina. Most of the work has been done with ordinary damped oscillations; more or less extensive resections of nose, ear, tongue, breast and other organs having been performed through the use of an ordinary Bard

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Parker stylette as the active electrode. Needless to say, the wounds thus resulting have always sloughed, and where closure was attempted at time of operation secondary suture was necessary. Since the use of a cutting current—with a low voltage continuous oscillation having become available, primary union is now the rule, unless extensive coagulation has had to be done along the suture line. There is no question but that the addition of the electric scalpel to the armamentarium of the high frequency surgeon greatly enhances his work; but some time will have to elapse before we will be able to judge as to its full value. The more rapid the cutting current, the more nearly it approaches the celerity of cold aseptic scalpel, and the less efficiently will the tissues thus divided be electrocoagulated. Since we are depending upon thermal penetration for our major effect, histologically, in the production of sealed blood vessels and lymphatics and in the possible destruction of cell nests beyond the line of incision—is it not likely that in many instances we may sacrifice efficiency of operation on the altar of time saving convenience and cosmetic vanity? It would seem much better to lay back flaps wherever practicable—with the rapidly acting continuous or “cutting” current and then attack the main lesion by electrocoagulation, rather than attempting the removal of the entire mass by the electric scalpel alone. The policy of circumvallation, described by Howard Kelly, by multiple circumscribing punctures each being progressively electrocoagulated and thus gradually dehematizing the neoplastic mass before its removal is a good one wherever practicable. In checking back over our cases we find that our failures have invariably been in those cases in which for some reason or other the operative procedure was not sufficiently radical.

Following is a resume of the first hundred carefully studied cases done by the author. The earliest of these dated back only five years, the latest only one year. These cases are unselected except that for some reason of special interest careful case histories were kept, accurate diagnoses made, and follow-up reports were available in every case. Operative procedure in this series was entirely by electrodesiccation, electro-

coagulation or electrothermic excision with Bard Parker knife activated by damped oscillations.

GROUP 1

Malignant neoplasms—34.

Biopsy positive, and recurrent after removal, 58 per cent.

No biopsy, but radiation resistant ulcers, 18 per cent.

No biopsy, but rapid growth, cauliflower, etc., 24 per cent.

Lues ruled out by Wasserman test and history in all cases.

Results in this series:

Deaths two (both with regional metastases when operated), 6 per cent.

Recurrences four (local recurrences—inadequate ablation), 12 per cent.

Total failures in malignant cases, 18 per cent.

Analysis of Failures—Deaths

Case 1. Sarcoma cervix uteri; age 21. Alive one year, died of general metastases. Secondary hemorrhage had necessitated ligation of the internal iliacs, and this plus radium post-operatively may have been responsible for the prolongation of life.

Case 2. Carcinoma of lip with cervical metastases which had developed during previous radiation therapy. Electrocoagulation of lip—good result. Block resection of neck followed by recurrence in the wound. Electrocoagulation of recurrent carcinoma unsuccessful, it being impossible to reach all the malignant tissue. Died six months after the first operation from hemorrhage of the carotid artery.

Note: Both these cases died, although the electrocoagulation was so extensively performed that both patients developed secondary hemorrhage. Note further that secondary hemorrhage in advanced cases is a real danger and that it may occur as late as six months after the primary operation. Both fatal cases were in the comparatively young, being under 50.

Recurrences

Case 1. Squamous celled cancer of the finger, man age 65. Recurrent in radium scar.

Electrodesiccation under local anesthetic insufficiently radical. Finger later amputated, and nests of cancer found just superficial to the periosteum—showing reason for failure of any sort of superficial removal. Recurrence occurred in this case within six months.

Case 2. Squamous celled cancer of the dorsum of the hand. Resistant to x-rays. The patient was an aged woman who refused amputation. Electrocoagulation was followed by very slow healing—but after three months skin grafts finally were successfully used. No local recurrence in the hand but the patient later developed malignancy just above the wrist. Since she refused any further treatment the outcome is problematical. She has remained alive, however, three years since the operation.

Case 3. Sarcoma evidently arising in the nerve sheath of the left musculospiral nerve. Man age 45. Right sided hemiplegia. Lues negative (?) Several unsuccessful excisions had been done. Electrosurgery failed also for the same reason that the others had failed—insufficiently radical operation. Recurrence within six months. Patient refused further treatment.

Case 4. Extensive rodent ulcer of the scalp with involvement of the skull. This was the only case in the entire series which complained of great pain after operation. Marked clinical improvement with the exhibition of antileptic therapy, but although the lesion was 90 per cent healed—when last seen, the patient has failed to report back as directed and is listed as a failure.

Resume of successful cases of malignant neoplasms: Average age above 60. There were ten cases of epithelioma of the nose, cheek, lip, ear, eyelid, hand, neck, vulva and one adenofibroma of the rectovaginal septum. These were electrocoagulated and required from 30 to 90 days for healing, with an average of 43 days. Eighteen cases distributed through the same areas were desiccated and required from 14 to 27 days for healing, with an average of 18 days. The electrocoagulated cases all showed more or less evidence of scar, although in no instance was it prominent or objectionable. The cases which were desiccated showed practically no

scar—in many instances the site of the lesion being almost obliterated after the lapse of a few months time.

GROUP 2.

Premalignant neoplasms, 40.

These lesions included verrucae, nevi, caruncle, fibroma and sebaceous adenoma. All were desiccated. Recurrence occurred in two verrucae—which were incompletely removed (without anesthetic). Wound healing without scarring—in about ten days to two weeks occurred uniformly in the entire group. All were of course ambulatory cases. Six cases of pigmented nevi were more radically treated than the rest, and required an average of 28 days for healing.

GROUP 3.

Miscellaneous infections, carbuncle, furuncle, luetic and tuberculous granulomata, 26.

This heterogeneous group showed uniformly good results. One tattoo case showed such extensive keloidal formation after its removal by desiccation that it is questionable as to whether he was much improved. In this case sharp scalpel incision and skin graft would likely have given better cosmetic results. Two other patients in this group expressed dissatisfaction with the scar, making a total of failures—three, or 12 per cent.

Total failures, deaths, recurrences or unsightly scar in entire series was twelve, as based upon questionnaire filled out by the patient and in which any dissatisfaction on his part was considered a failure on the part of the operation to give complete satisfaction. Total failures then in this series were 12 per cent of the entire series, and 18 per cent of the malignant cases.

SUMMARY AND CONCLUSIONS

1. Electrosurgery, skillfully performed is a valuable addition to our therapeutic resources—particularly in dealing with superficial malignant and premalignant neoplasms, and with infectious granulomata.

2. Electrosurgery is not a panacea for such affections, does not replace ordinary operative measures in body cavities, and to be of most value should be utilized in conjunction with other agencies such as ultraviolet radiation, x-ray and radium.

EDITORIAL

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

Eighth Annual Meeting,
November 4, 5, 6 and 7, 1929,
Hotel Sherman,
Chicago.

FOAM THERAPY

Renewed interest in the physiologic possibilities of hydrotherapy is at present manifested in various European clinics because of the striking results obtained by Sandor, an Hungarian engineer, with a modified method of hydrotherapy, spoken of as "foam therapy." Sandor has demonstrated (and since then others) that external body heating with resorption of chemical products and gases could be materially augmented by incorporating within a specially constructed water-bath, a foam-producing agent, from a vegetable nonpoisonous saponine. The exact nature of this vegetable product, so far as we know, is still somewhat of a secret. Nagelschmidt, who was the first to advocate its use before an English speaking audience, is decidedly vague as to the formula utilized to produce the exact foam-forming effect. More recently W. Kerr Russell has added to the literature an explicit exposition of his personal observations and studies on the continent, in regard to this new form of therapy. He also is vague with reference to the nature of this "foam-forming extract."

It appears that when a small amount of air under a definite atmospheric pressure is passed through porous blocks of wood into a bath that contains a small amount of water in which this "extract" is in intimate solution, fine pearly bubbles are created which eventually fills the entire bathtub. The patient emersed in this medium receives a double benefit in the nature of

heat which apparently is more bearable under these circumstances and from the impact and burst of numerous fine bubbles adjacent to his skin. A delicate, sedative massage is experienced by the patient, while the heat, more comfortable because of the reduced hydrostatic quality of the foam, accelerates metabolic processes. This form of therapy therefore finds its greatest indication in chronic arthritis, myositis, neuralgias, essential hypertension and adiposities associated with a lowered metabolism.

Its ability to actively resorb chemical products and certain gases introduces into modern physical therapeutics a measure of great flexibility and potentiality. The absorption of saponines have been studied by Professor Kobert and more recently by Kofler of Switzerland, who have shown that ordinary soaps cannot be absorbed by the intestines or mucous membranes. Although the saponic extract utilized for purpose of foam therapy is a neutral vegetable soap which in itself is non-absorbable, it paradoxically is of material aid in the absorption of other substances. Nagelschmidt has called attention to this phenomenon and more recently Russell has stated that

"certain drugs which are nontoxic when administered alone can become extremely poisonous when given in conjunction with foam or foam-forming agents, e. g., magnesium sulphate administered with foam can produce magnesium poisoning. One fiftieth part of the lethal dose of strophanthin or digitalis, when given with foam, can produce the same harmful effect as the lethal dose itself."

The possibilities of utilizing minute qualities of drugs with this form of bathing suggests itself as a plausible measure. The combination of the gas, carbon dioxide, with foam therapy is already proving to be a measure superior to artificial Nauheim bathing, and can be utilized in any institution with bath-tub facilities. Whether the beneficial effect is due to the friction of the

numerous small bursting bubbles on the skin, or more likely to dissolved carbon dioxide acting as a rubifacient, the effect, nevertheless is favorably pronounced in conditions of valvular and myocardiac affections and in circulatory disturbances. The sedative effect of oxygen foam bath-

ing on the other hand warrants trial in insomnia, neuresthenia and other nervous conditions.

With the orientation that comes with greater experience it is anticipated that the advocacy for foam therapy will be more definitely justified and its indications more widely extended.—D. K.

American College of Physical Therapy Chicago, Nov. 4, 5, 6, 7. Hotel Sherman

Preliminary Program

Clinics

Section on Eye, Ear, Nose and Throat

9:00 to 10:30	MONDAY, NOV. 4	TUESDAY, NOV. 5, <i>Chronic Suppurative Otitis Media—</i> M. H. COTTLE, M.D., Chicago.	WEDNESDAY, NOV. 6 <i>The Filling of Sinuses by the Dis- placement Method—</i> ARTHUR W. PROETZ, M.D., St. Louis, Mo.
10:45 to 12:45	<i>Middle Ear Deafness—</i> ELLIS G. LINN, M.D., Des Moines, Iowa.	<i>Physical Therapy in Ear, Nose and Throat Diseases: Scope and Limi- tations—</i> F. G. WAHRER, M.D., Marshalltown, Iowa.	<i>Malignant Diseases of the Ear, Nose and Throat—</i> T. C. GALLOWAY, M.D., Evanston, Ill.

Section on Surgery (and the Surgical Specialties)

9:00 to 10:30	MONDAY, NOV. 4 <i>Gynecologic Diseases—</i> J. E. G. WADDINGTON, M.D., Detroit, Mich.	TUESDAY, NOV. 5 <i>Urologic Diseases—</i> GUSTAV KOLISCHER, M.D., Chicago.	WEDNESDAY, NOV. 6 <i>Pulmonary Surgery—</i> RALPH B. BETTMAN, M.D., Chicago.
10:45 to 12:15	<i>Accessible Neoplasms—</i> D. KOBAK, M.D., Chicago, Ill.	<i>Industrial Surgery—</i> FRANK H. WALKE, M.D., Shreveport, La.	<i>X-Ray and Radium Therapy—</i> A. F. TYLER, M.D., Omaha, Nebr.

Section on Medicine (and the Medical Specialties)

9:00 to 10:30	MONDAY, NOV. 4 <i>X-ray Therapy—Methods of Dosage, Biological Laws and Treatment Methods—</i> ALBERT BACHEM, Ph.D., Chicago.	TUESDAY, NOV. 5 <i>Arthritis—</i> J. C. ELSOM, M.D., Madison, Wis.	WEDNESDAY, NOV. 6 <i>Dermatological Diseases—</i> A. E. SCHILLER, M.D., Detroit, Mich.
10:45 to 12:15	<i>Pneumonia and Chest Diseases—</i> GAGE CLEMENT, M.D., Duluth, Minn.	<i>Hypertension—</i> CURRAN POPE, M.D., Louisville, Ky.	<i>Low Tension Currents—</i> J. U. GIESEY, M.D., Salt Lake City, Utah.

Program

SECTION ON MEDICINE, DIAGNOSIS, PEDIATRICS, NEUROLOGY, ENDOCRINOLOGY

Monday Afternoon, November 4, 1929

The Use of Physiotherapy in the Care of Diseases of the Circulation.

LOUIS FAUGERES BISHOP, M. D., and
LOUIS FAUGERES, JR., M.D.,
New York City

Discussion opened by C. E. Stewart, M.D., Battle Creek, Mich., and Curran Pope, M.D., Louisville, Ky.

Further Observations on Diathermy in Pneumonia.

F. B. FREELAND, M.D., Portland, Ore.
Discussion opened by Gage Clement, M.D., Duluth, Minn.

Diathermia and Other Physical Agents in Treatment of Pneumonia and its Sequelae.

ADOLPH A. LILIEN, M.D., New York City.
Discussion opened by Damien St. Pierre, M.D., Windsor, Ont., Canada, and Lloyd M. Otis, M.D., Celina, Ohio.

Changes Occurring in the Blood of New-Born Infants Following Ultraviolet Therapy.

HEYWORTH N. SANFORD, M.D., Chicago
Discussion opened by M. L. Blatt, M.D., Chicago; Clifford G. Grulee, M.D., Chicago, and H. E. Irish, M.D., Chicago.

Physical Therapy in Gastro-Intestinal Disease.

LOUIS H. LEVY, M.D., New York City.
Discussion opened by Wm. Brams, M.D., Chicago, and George B. Lake, M.D., Chicago.

SECTION ON EYE, EAR, NOSE AND THROAT

Monday Afternoon, November 4, 1929

The Method of Choice in Tonsillectomy.

F. L. WAHRER, M.D., Marshalltown, Iowa.
Discussion opened by Gregg A. Dillinger, M.D., Pittsburgh, Pa., and J. H. Hester, M. D., Louisville, Ky.

The Treatment of Facial Paralysis.

W. L. CAHALL, M.D., Utica, N. Y.
Discussion opened by J. C. Elsom, M.D., Madison, Wis., and J. U. Giesey, M.D., Salt Lake City, Utah.

Radium in the Post Operative Treatment of Polypoid Sinusitis.

G. ALLEN ROBINSON, M.D., New York City.
Discussion opened by Roy Emmert Flesher, M.D., Chicago, and A. F. Tyler, M.D., Omaha, Nebr.

Physiotherapy as an Adjunct in the Treatment of Atrophic Rhinitis.

CARL B. SPUTH, M.D., Indianapolis, Ind.
Discussion opened by F. L. Alloway, M.D., Champaign, Ill., and F. L. Wahrer, M.D., Marshalltown, Iowa.

The Influence of Ultraviolet Radiations on Periodontal Diseases.

A. T. RAWMUSSEN, D.D.S., La Crosse, Wis.
Discussion opened by S. Wollenberger, D.D.S., Chicago, and C. E. Norris, D.D.S., Indianapolis, Ind

SECTION ON SURGERY, GYNECOLOGY, ORTHOPEDICS AND UROLOGY

Monday Afternoon, November 4, 1929

The Use of Physiotherapy in Traumatic Cases.

E. H. REBHORN, M.D., Scranton, Pa.
Discussion opened by John Ellis, M.D., Chicago, and Frank H. Walke, M.D., Louisville, Ky.

Physical Therapy in Industry.

C. H. OGDEN, M.D., Chicago.
Discussion opened by J. S. Coulter, M.D., Chicago, and R. W. McNealy, M.D., Chicago.

Low Voltage Currents in Contractures of the Hand.

LOUIS GRIES, M.D., Chicago.
Discussion opened by Frederick H. Morse, M.D., Boston, and C. M. Westerman, M.D., St. Louis.

Physical Therapy Indications in Gynecology.

JOSEPH E. G. WADDINGTON, M.D.,
Detroit, Mich.

Discussion opened by Louis Rudolph, M.D., Chicago, and H. D. Holman, M.D., Mason City, Iowa.
After Treatment of Tarsal and Metatarsal Fractures.

JOHN D. ELLIS, M.D., Chicago.

Discussion opened by P. H. Dorne, M.D., Chicago, and C. R. G. Forrester, M.D., Chicago.

Evening Session, Monday, November 4, 1929

Experimental Studies in Pernicious Anemia, Pemphigus and Leprosy.

DAVID I. MACHT, Ph.D.,
Johns Hopkins University, Baltimore, Md.
Discussion opened by Leon Bloch, M.D., Chicago, Erwin P. Zeisler, M.D., and Francis E. Seneor, M.D., Chicago.

The Penetration of Ultraviolet Light Into the Human Skin.

ALBERT BACHEM, Ph.D.,
University of Illinois, Chicago.
Discussion opened by David I. Macht, Ph.D., Baltimore, Md., and I. S. Falk, M.D., Chicago.

SECTION ON MEDICINE, DIAGNOSIS, PEDIATRICS, NEUROLOGY, ENDOCRINOLOGY

Tuesday Afternoon, November 5, 1929

Radiant Energy as Applied to Skin Lesions.

WALTER J. HIGHMAN, M. D., New York City.
Discussion opened by C. H. Warfield, M.D., Chicago, and Benj. H. Sheman, M.D., Dexter, Iowa.

A Successful Electro-chemical Treatment for Acne.

C. AUGUSTUS SIMPSON, M.D., and
H. FORD ANDERSON, M.D.,
Washington, D. C.

Discussion opened by A. F. Tyler, M.D., Omaha, Nebr., and Louis Gries, M.D., Chicago.

Chronic Arthritis, Classification with Reference to Treatment.

N. J. SEYBOLD, M.D., Toledo, Ohio.

Discussion opened by J. C. Elsom, M.D., Madison, Wis., and J. S. Coulter, M.D., Chicago.

Ultraviolet Radiation and Medical Care Versus Surgery in the Treatment of Renal Tuberculosis.

ALBERT M. CRANCE, M.D., Geneva, New York.

Discussion opened by Gustav Kolischer, M.D., Chicago, and Owsley Grant, M.D., Louisville, Ky.

Blood Metabolism, Old Theory vs. New.

HAROLD M. JOHNSON, M.D., Buffalo, N. Y.

SECTION ON SURGERY, GYNECOLOGY, ORTHOPEDICS AND UROLOGY

Tuesday Afternoon, November 5, 1929

Contraindications to the Use of Physiotherapy in the Treatment of Goiter.

ARNOLD S. JACKSON, M.D., Madison, Wis.

Discussion opened by Maximilian Kern, M.D., Chicago.

Seminal Vesiculitis and Diathermy.

WINFIELD SCOTT PUGH, M.D., New York City

Discussion opened by H. C. Rolnick, M.D., Chicago, and Edwin W. Hirsch, M.D., Chicago.

Nonvolatile Anesthesia in Electrosurgery—With Special Reference to Intravenous Somital.

EDWIN N. KIME, M.D., Indianapolis, Ind.

Discussion opened by G. Kolischer, M.D., Chicago, and D. Kobak, M.D., Chicago.

The Prognostic Value of the Malignancy Index Based on Five Year End Results of Carcinomata of the Breast and Cervix.

HENRY SCHMITZ, M.D., Chicago.

Discussion opened by Gustavus M. Blech, M.D., Chicago, and A. David Willmoth, M.D., Louisville, Ky.

Newer Concept of Surgery in Breast Cases. (Illustrated with Moving Pictures)

A. DAVID WILLMOTH, M.D., Louisville, Ky.

Discussion opened by Emil Beck, M.D., Chicago, and G. M. Blech, M.D., Chicago.

SECTION ON EYE, EAR, NOSE AND THROAT

Tuesday Afternoon, November 5, 1929

Value of Iodized Oil in Nasal Accessory Sinus Disease.

ROBERT W. FRAZER, M.D., Battle Creek, Mich.

Discussion opened by Harold Hays, M.D., New York City, and Frank J. Novak, Jr., M.D., Chicago.

Tribromethylalcohol (Avertin) Anesthesia for Electro-surgery About the Head and Neck.

W. REESE GUTTMAN, M.D., and

JOSEPH R. GUTTMAN, M.D., Chicago, Ill.

Discussion opened by Edwin N. Kime, M.D., Indianapolis, Ind., and Thomas C. Galloway, M.D., Evanston, Ill.

Surgical Diathermia in Accessible Neoplasms About the Head.

GEORGE W. BOOT, M.D., Evanston, Ill.

Discussion opened by A. L. Yocum, M.D., Chariton, Iowa; D. Kobak, M.D., Chicago, and J. Thompson Stevens, M.D., Montclair, N. J.

The Treatment of Deafness by Physical Therapy. (With demonstration of some new appliances.)

LOUIS H. LEVY, M.D., New York City.

Discussion opened by Ellis G. Linn, M.D., Des Moines, Iowa, and A. R. Hollender, M.D., Chicago.

Electrocoagulation in Tonsil Dissections.

W. H. TAYLOR, M.D., St. Marys, Ont., Canada.

Discussion opened by Raymond F. Elmer, M.D., Chicago, and P. H. Greeley, M.D., Portsmouth, N.H.

Evening Session, Tuesday, November 5, 1929

Important Facts Concerning the Diathermy Machine and Its Current.

WILHELM STENSTROM, Ph.D.,

Associate Profesosr Biophysics,

University of Minnesota, Minneapolis, Minn.

Discussion opened by Disraeli Kobak, M.D., Chicago; F. H. Ewerhardt, M.D., St. Louis, Mo., and Norman E. Titus, M.D., New York City.

Physical Therapy in the Regulation of Acid-Base Equilibrium.

Victor E. Levine, M.D., Ph.D., Creighton University, Omaha, Nebr.

Discussion opened by A. C. Ivy, Ph.D., Northwestern University, Chicago, and C. I. Reed, Ph.D., Chicago.

SECTION ON MEDICINE, DIAGNOSIS, PEDIATRICS, NEUROLOGY, ENDOCRINOLOGY

Wednesday Afternoon, November 6, 1929

Muscle Education.

JOHN S. COULTER, M.D., Chicago.

Discussion opened by Louis Gries, M.D., Chicago, and Norman E. Titus, M.D., New York City.

Radium as a Therapeutic Agent.

C. J. BROEMAN, M.D., Cincinnati, Ohio

Discussion opened by F. E. Simpson, M.D., Chicago, and A. F. Tyler, M.D., Omaha, Nebr.

Physical Therapy in Gastro-Enterology: Some Atonic Conditions and Their Treatment.

C. F. VOYLES, M.D., Indianapolis, Ind.

Discussion opened by I. M. Trace, M.D., Chicago, and B. H. Sherman, M.D., Dexter, Iowa.

Physical Therapy in Arthritis.

PHILIP LEWIN, M.D., Chicago.

Discussion opened by J. C. Elsom, M.D., Madison, Wis., and Frank H. Walke, M.D., Shreveport, La.

SECTION ON EYE, EAR, NOSE AND THROAT

Wednesday Afternoon, November 6, 1929

Asthma—Its Diagnosis and Treatment.

FERRIS SMITH, M.D., Grand Rapids, Mich.

Discussion opened by Arthur W. Proetz, M.D., St. Louis, Mo.; John J. Shea, M.D., Memphis, Tenn., and Ellis B. Freilich, M.D., Chicago.

Physical and Electro-Therapy in Oto-Laryngology.

HAROLD HAYS, M.D., New York City.

Discussion opened by Frank J. Novak, Jr., M.D., Chicago, and Harry L. Pollock, M.D., Chicago.

Physical Procedures in the Treatment of Nasal Sinuses.

ARTHUR W. PROETZ, M.D., St. Louis, Mo.

Discussion opened by A. H. Andrews, M.D., Chicago, and George W. Boot, M.D., Chicago.

Electro-Therapeutics as Applied to Modern Oto-Laryngology.

JOHN J. SHEA, M.D., Memphis, Tenn.

Discussion opened by M. H. Cottle, M.D., Chicago, and F. L. Wahrer, M.D., Marshalltown, Iowa.

Small X-Ray Dosage in Deafness.

J. J. RICHARDSON, M.D., Washington, D. C.

Discussion opened by Harry Thometz, M.D., Chicago, and W. L. Cahall, M.D., Utica, N. Y.

SECTION ON SURGERY, GYNECOLOGY, ORTHOPEDICS AND UROLOGY

Wednesday Afternoon, November 6, 1929

The High Frequency Currents in the Treatment of Cancer.

H. HARTWELL BASS, M.D., Durham, N. C.

Discussion opened by Roswell T. Pettit, M.D., Ottawa, Ill., and A. L. Yocom, M.D., Chariton, Ia.

Radiosensitivity of Tumors.

GAGE CLEMENT, M.D., Duluth, Minn.

Discussion opened by Julius Brams, M.D., Chicago, and N. S. Zeitlin, M.D., Chicago.

The High Frequency Current in the Treatment of Chronic Endocervicitis.

MORTIMER N. HYAMS, M.D., New York City.

Discussion opened by Budd C. Corbus, M.D., Chicago, and Miles J. Breuer, M.D., Lincoln, Nebr.

Ultraviolet as an Aid in the Preparation of a Patient for Operation.

VICTOR E. LEVINE, M.D., Ph.D.,

Creighton University, Omaha, Nebr.

Discussion opened by Edwin N. Kime, M.D., Indianapolis, Ind., and E. C. Henry, M.D., Omaha, Nebr.

A Statistical Study of the Uses of Diathermy and the Actinic Ray in a Gynecological and Obstetrical Practice. With Brief Report of a Few Interesting Cases.

THOMAS B. SELLERS, M.D., F.A.C.S., and

JOHN T. SANDERS, M.D., New Orleans, La.

Discussion opened by Haldor Carlsen, M.D., Chicago, and H. D. Holman, M.D., Mason City, Iowa.

JOINT MEETING OF ALL SECTIONS

Thursday Morning, November 7, 1929

Sun Cure for Tuberculous Children.

RICHARD T. ELLISON, M.D., Philadelphia, Pa.

Discussion opened by I. Harrison Tumpeer, M.D., Chicago, and Benj. Goldberg, M.D., Chicago.

Treatment of Pain in the Arm and Leg.

ARCHIBALD P. EVANS, M.D., New York City.

Discussion opened by J. U. Giesey, M.D., Salt Lake City, Utah, and Esther T. Frankel, M.D., Chicago.

Neon-Mercury Cold Light as Applied by Applicators to Cavities of the Body, Such as the Nasal, Buccal and Rectal. (Lantern slides.)

F. H. REDEWILL, B.S., M.A., M.D.,

LT. COM. JAMES POTTER, M.D., U.S.N.,

COM. HARRY GARRISON, M.D., U.S.N.,

San Francisco, Calif.

Discussion opened by J. E. G. Waddington, M.D., Detroit, Mich., and Edwin N. Kime, M.D., Indianapolis, Ind.

Thursday Afternoon, November 7, 1929

Accuracy in the Measurement of X-ray and Radium Doses.

U. V. PORTMAN, M.D., Cleveland, Ohio.

Discussion opened by Norman E. Titus, M.D., New York City, and Roswell T. Pettit, M.D., Ottawa, Ill.

Motion Picture Demonstration of the Treatment of Bone Infections.

MAX THOREK, M.D., Chicago.

Discussion opened by Maurice Bernstein, M.D., Chicago, and F. W. Carruthers, M.D., Little Rock, Ark.

The Resistance of Various Tissues for Various Electric Currents.

ALBERT BACHEM, Ph.D., Chicago.

Discussion opened by D. Kobek, M.D., Chicago, and Norman E. Titus, M.D., New York City.

EXAMINATION OF TECHNICIANS FOR CERTIFICATION BY TECHNICIANS' BUREAU, AMERICAN COLLEGE OF PHYSICAL THERAPY

For the past two years the Technicians' Bureau of the American College of Physical Therapy has conducted a qualifying examination for the purpose of certifying technicians who are qualified in physical therapy as non-medical assistants. A large number of technicians have taken these examinations and a good number have already registered for this year's examination which will be conducted on Friday, November 8th, at the Hotel Sherman.

Technicians contemplating attendance at the annual session and registering for the exam-

ination are urged to apply at once. A technician must show proper educational qualifications before being permitted to the examination. No applicant is accepted who has been in the work less than one year, unless the course of instruction has been under personal supervision of prominent physicians who will vouch for the nature of the work and the readiness of the applicant to be examined.

Fellows of the college are urged to encourage their assistants to take this examination. The ground covered includes a theoretical and practical consideration of light thermotherapy, electricity: low and high tension currents, conduct, ethics and such practical phases of the subject with which a good technician should be acquainted. A fee of ten dollars must accompany the application. This fee is payable only once and in the event of failure applicant is permitted to take a second examination within one year without charge. No fee is made for the certificate. Send for further information and application forms to:

Technicians Bureau,
American College of Physical Therapy,
Suite 716-30 N. Michigan Avenue,
Chicago, Ill.

PHYSICAL THERAPY PROGRESS

The first "endowed" physical therapy department has been started in a Chicago hospital. The Milton Hartman Fund of \$100,000 is being used to establish a Curative Workshop in the Mandel Clinic of Michael Reese Hospital. Here, physical and occupational therapy will be combined for the restoration of function in such cases as infantile and spastic paralysis in children, industrial injuries and other orthopedic cases. It will be under the direction of Dr. J. S. Coulter, associate editor of *The Radiological Review* and Assistant Professor of Physical Therapy, and Dr. D. H. Levinthal, Instructor in Orthopedic Surgery at Northwestern University Medical School, and will also be used for teaching.

ACTINOTHERAPY ENLARGES BOARD

It is announced by the British Journal of Actinotherapy and Physiotherapy (17, Featherstone Buildings, London, W. C. 1.), that the following specialists have accepted an invitation to join the honorary advisory editorial board of the Journal: Sir William Willcox, K.C.I.E., C.B., C.M.G., M.D.; Sir R. Stanton Woods, M.D.; Dr. L. Danyers Bailey, Dr. C. W. Buckley, Dr. Malcolm Campbell, Dr. Vincent Coates, Dr. E. P. Cumberbatch, Dr. R. Fortescue Fox, Dr. Frank D. Howitt, C.V.O.; Dr. R. J. L. Llewellyn, Dr. G. L. Kerr Pringle, Dr. Matthew B. Ray and Dr. Justina Wilson.

The purpose of these additions to the board is to represent more adequately the branches of physical therapy outside artificial light treatment. With these additions the board now comprises thirty-two specialists at home and abroad representing all the main divisions of physical therapeutics.

ACME AND ENGELN MERGE

The merger of the Acme-International X-Ray Company of Chicago and the Engeln Electric Company of Cleveland, to be known as the American X-Ray Corporation, has just been announced, effective July 1st, 1929. Both of these companies have for many years played a conspicuous role in the development of x-ray and physical therapy apparatus, and have won a vast number of friends in the medical profession throughout the country.

The extensive lines of both companies will be retained, essentially unchanged, and a wide distributing organization, covering the United States and many foreign countries, will be maintained to service the products and give the closest personal attention to the requirements of the medical profession.

This concentration, bringing together greatly increased facilities for production, research, experimental and educational activities, should prove of striking benefit to the profession, which is now offered an exceptionally wide line from which to choose suitable equipment,

and is assured of excellent service facilities in any part of the country.

Leonard A. Busby, president of the Chicago City Railways, was elected president of the American X-Ray Corporation, a very good index of the financial strength and the sound business policies which characterize this new

organization. The officials who have in the past guided the two companies to a position of leadership in the industry, remain actively in charge of its management: H. P. Engeln, first vice president, in charge of sales; Frank L. Severance, vice president and general manager; and Montford Morrison, vice president and chief engineer.

THE STUDENT'S LIBRARY

BOOKS RECEIVED

This column is devoted to acknowledgment of the books received. Such acknowledgment must be regarded by the sender as sufficient recognition of the courtesy until time and space permit selections to be made for review.

SELECTED READINGS IN PATHOLOGY. By *Esmond R. Long*, Professor of Pathology, University of Chicago. With 25 plate illustrations and 301 pp. Price \$4.00. Springfield, Ill.: Charles C. Thomas, Publisher.

BOOKS REVIEWED

CHRONIC (NON-TUBERCULOUS) ARTHRITIS: By *A. G. Timbrell Fisher*, M.C., F.R.C.S. (Eng.). Late Hunterian Professor, Royal College of Surgeons of England, 1921 and 1922, Surgeon Seamen's Hospital, Greenwich; Joint Lecturer on Operative Surgery, London School of Clinical Medicine; Visiting Surgeon in Charge of Special Clinic, Ministry of Pensions Hospital, Orpington, etc. Price \$7.70. Pp. 232, with 186 illustrations. New York: The Macmillan Company 1929.

This volume appears almost the same month as the book "Arthritis and Rheumatoid Conditions," by *Ralph Pemberton*, M.D., which latter volume deals, however, in much greater length with the recent research which has been done on the etiology of these conditions and their aspects from the standpoint of the internist.

Fisher's volume gives a very clear delineation of the pathological and x-ray findings of the various types and deals with the subject of treatment more from the standpoint of the orthopedic and operative surgeon.

Physiotherapeutic indications are covered in detail, special instructions being given for the application of the various modalities.

THE NATURE OF THE PHYSICAL WORLD. (The Gifford Lectures 1927) *A. S. Eddington*, M.A., LL.D., D.Sc., F.R.S. Plumian Professor of Astronomy in the University of Cambridge. Pp. 361. New York: The Macmillan Company, Publishers, 1929.

The author has contributed a popular exposition on the latest physical advances in science—a subject now recognized to be basically allied to physical therapy. "The Nature of the Physical World" falls in line with the fundamental concepts that is now being taught to students of physical therapy. This book therefore is a timely contribution and fills a popular demand. Anyone interested in the foregoing specialty will find this book extremely fascinating because it is filled with pertinent facts and presented in an intimate style devoid of mathematical formulas. It is written for the lay person and non-technical student of physics. Professor Eddington has presented the newer facts of physics in relation to the nature of the physical world in a sympathetic, clear and eloquent manner that holds the interest of the reader even beyond the last page. He has painted a vivid and detailed picture on a tremendous

canvas. In the fifteen chapters that go to make up this fascinating volume the author has covered the following subjects: "The Downfall of Classical Physics; Relativity; Time; The Running Down of the Universe; 'Becoming' Gravitation—the Law; Gravitation—the Explanation; Man's Place in the Universe; The Quantum Theory; The New Quantum Theory; World Building; Pointer Reading; Reality; Causation; Science and Mysticism."

It is fortunate that the author is so happily oriented to his subject. He brings to the book that essential clarity of style so necessary to hold the attention of the reader, especially on a subject so little understood and more frequently misunderstood. This book is highly recommended to the profession and particularly to those interested in physical therapy.

SURGICAL RADIOLOGY. By *A. P. Bertwistle*, M.B., Ch.B., F.R.C.S., Ed. Late Surgical Officer, General Infirmary at Leeds. With an introduction by *D. P. D. Wilkie*, O.B.E., F.R.C.S., Professor of Surgery, University of Edinburgh. Pp. 142, with 21 illustrations. Philadelphia: P. Blakiston's Sons & Co., 1012 Walnut St., Publisher, 1929.

This small volume was written with the frank intention to be a guide to the clinician in the interpretation of x-ray pictures. In his preface the author states that an "attempt is made to give brief descriptions of early disease. It is hoped that their brevity will not make them appear dogmatic. Clinical notes endow the 'shades' of radiology with life." One is pleasantly surprised to note the extensive material packed into the confines of this small volume. Its very brevity

is a recommendation. The busy practitioner who is most in need of its intelligent guidance because he cannot afford the time to read scholarly or padded discussions will appreciate this most. The illustrations and the graphic manner with which various diseases are depicted is a feature to be highly commended. Here is a practical book on surgical radiology that should be on the desk, or within easy reach of the modern practitioner of medicine. It is concise and thoroughly practical.

A SURGICAL DIAGNOSIS. By *Lewis Donhauser*, A.B., M.C., F.A.C.S., Clinical Professor of Surgery, Albany Medical College (Union University); Associate Surgeon, Albany Hospital; Attending Surgeon, Childs Hospital, Albany. Pp. 799. Illustrated. New York City: D. Appleton & Company, Publishers.

This volume should have a special appeal to the practitioner of general medicine and to the specialist for it has successfully achieved that elusive goal—an interpretation of surgical conditions in a practical manner. The author has stressed the value of properly interpreting symptoms and the clinical findings. He has, therefore, devoted a large initial chapter to the taking of history and the correlating of the symptoms in order to achieve an intelligent diagnosis. The book is richly interspersed with regional and etiologic charts and differential outlines. It is encyclopedic with practical suggestions. There is detail without padding, and a lucid interpretation of surgical symptoms that indicates long years of teaching. The book thoroughly covers the entire range of surgical diagnosis in a comprehensive and pleasing manner. We highly recommend this book to the profession.

INTERNATIONAL ABSTRACTS

The Problem of Lipiodol Injections Into the Uterus and Tubes. *P. Manclaire* (Paris) *Bull. Soc. Nat. Chir.*, No. 54, 1928.

The author praises lipiodol x-ray examination as an aid in the diagnosis of such congenital malformations as infantile uterus, didelphic uterus, atrophy, strictures, diverticula of the tubes, etc. The author calls attention to the fact that spasm of the tubes which may be the cause of sterility, tubal (ectopic) pregnancy or torsion of the tube cannot be differentiated roentgenologically from organic changes producing stenosis by one simple examination, repeated examinations being essential to guard against mistaken diagnoses. In spite of the antiseptic qualities of lipiodol the author cautions against its use in the presence of infectious processes in the uterus or tubes.

Fundamentals of Hysterosalpingography. *G. K. F. Schultz* (Berlin) *Ztschr. F. Geb.*, No. 93, 1928.

The author reviews the physiologic and pathologic basis of the roentgenograms from a large amount of material. He points out that pictures of one and the same patient may vary, depending on the tonic state of the organs. Against these functional variations changes in the pictures of tubes due to organic disturbances can be generally more easily interpreted. The true value of the method for the clinical diagnosis will be obtained only if a number of pictures taken as a series through a prolonged period will be compared with the clinical course, especially when confirmed by laparotomy. Today nothing positive can be said as yet. Individual positive pictures only prove the possibility of

recognizing roentgenologically one or the other changes. The author thinks that the question to what extent a negative picture can be accepted to exclude with certainty a pathologic change, is of even greater importance for the practice of gynecology.

Dangers of Hysterography by Intrauterine Injection. P. Duval (Paris). Bulletin Soc. Nat. Chir., 54, 1928.

Basing on a fatal case following an injection of umbrenal in a German university clinic, of another of peritoneal irritation following an injection of iodipin and grave changes following injections of sodium bromide also in a German clinic, the author is forced to regard this method of examination not at all as free from danger as is commonly accepted, especially so in France. As regards the objection made that the above contract agents were others than lipiodol, Duval points out that it is not the medium used which is dangerous but the carrying of infectious material to distant places which must be held responsible. Finally Duval asserts that this method of examination does not afford sufficiently valuable information to justify taking the risk into the bargain. While the author does not definitely reject the method he cautions against its misuse.

Roentgen Studies of Arteriosclerosis in the Peripheral Arteries. C. Lundsgaard and E. Rud (Copenhagen). Acta. Med. Scand. Supplement, 26, 1928.

The authors studied 345 patients, 193 men and 152 women, the majority of whom suffered from heart and kidney diseases. Arteriosclerosis was found in 52 per cent of the men and in only 9 per cent of the women. It was never observed in patients under forty years of age. The age itself seems to have no influence as far as the ratio of frequency is concerned. In only two-thirds of the cases in which arteriosclerosis was demonstrated roentgenologically could changes in the peripheral arteries be recognized by palpation. Changes in the arteries of the retina were seen in 58 per cent of the cases.

The authors emphasize that great care is to be exercised in drawing conclusions from the peripheral arteriosclerosis with regard to the condition of the remaining blood vessels of the body, and this is particularly as applicable with reference to the condition of the heart.

An Ultraviolet Component of the Sunlight of Portland, Ore. Ira A. Manville. Am. J. Dis. Child., 37:972-996, May, 1929.

Portland, Oregon, as a representative locality in the northwest, has the lowest annual average sunshine of all areas in the United States. Michigan, Maine, Vermont, New York and the Ohio Valley receive almost as low a percentage.

Plotting the curve for ultraviolet light against that of temperature, rainfall and sunshine shows that the closest correlation exists between ultraviolet light and sunshine, the least between it and the temperature and

that a possible inverse relationship exists between ultraviolet light and rainfall.

The readings for 1928 cannot be vitiated by the fact that it appears to be a year usually low in sunshine, for two reasons: (1) the deviation of the average for 1928 from the average for the preceding thirty-five years is well within the maximum and minimum deviation (22 per cent and 0.9 per cent); and (2) the average for 1928 deviates from the mean to the preceding thirty-five years by only 1.7 per cent, the average deviation being 9.4 per cent.

Instead of the amount of ultraviolet light gradually increasing as the months progress, as occurs in London and Toronto and as one would expect from the gradual increase in the amount of sunshine, there is an extreme fluctuation, so that only one month (July) shows a higher average than February.

The pall of smoke hanging over the Northwest during the late spring, summer and early fall is considered more a menace than a nuisance.

The Clinical Significance of Inflation of the Tubes and of Hysterosalpingography. G. Haselhorst (Hamburg) Ztschr. F. Geburtshilfe. No. 93, 1928.

Experience with this method of examination and the interpretation of the x-ray pictures acquired by it is essential for the use of hysterosalpingography which should never be done except in a hospital or clinic. While air inflation of the tubes is the method of choice in uncomplicated sterility, hysterosalpingography serves to supplement perturbation, that is to say in cases in which the air passes the tubes either with difficulty or in one sided occlusion resulting from diseases of the small pelvis. Occasionally the method is indicated beyond that, i. e., in stubborn affections in which clinically a diseased focus cannot be established, in which cases the roentgenogram will show an occlusion of a tube with adhesions. Furthermore the x-ray will serve as a control following plastic operations to show whether permeability has been attained or anomalies have been removed permanently. The author positively rejects any other indications for hysterosalpingography.

Irradiation of Ovaries and Hypophysis in Menstrual Disorders. F. A. Ford and D. G. Drips. Radiol., 12:393-402, May, 1929.

Irradiation of ovaries or hypophysis has been effective in re-establishing menstruation in patients in whom prolonged use of organotherapy had been ineffective.

A conclusion cannot be drawn as to the comparative efficiency of methods because the cases selected for irradiation were of unusual severity.

Irradiation of the hypophysis, occasionally combined with splenic and hepatic irradiation has exerted a temporary regulating effect in seven cases of severe menorrhagia and metrorrhagia; with supplementary treatment, the effect in two cases has persisted more

than one year. Relief of dysmenorrhea has been incidental in certain cases of menorrhagia and oligmenorrhea. Of six cases treated primarily for dysmenorrhea, relief has been complete in three and has lasted for a period of four to six months; improvement occurred in two others. Irradiation of ovaries of white rats in various dosages has resulted as follows: There was no continued influence on the regularity of the estrual cycle. Complete destruction of follicles did not result from dosages up to 2.5 unit skin doses.

Standardization of X-ray and Radium Treatment of Carcinoma of the Cervix. W. S. Lawrence. Radiol., 12:429-434, May, 1929.

A review of the literature reveals a regrettable diversity of opinion on the radiological management of this disease. The author believes it can be theoretically demonstrated and upheld by recorded results that the gamma rays of radium and x-rays are equally important in the radiotherapeutic management of carcinoma of the cervix, and he thinks that no one is justified in using one for the exclusion of the other.

In early cases, radium is of chief importance, but all of these cases would be safer if external radiation were added shortly after the radium treatment.

In borderline cases, radium and x-ray are of equal importance. Either may precede, but the other should follow within a week or ten days as a supplement.

In advanced cases, the x-ray is of far greater importance than radium and should always be given first. Its action, however, should be supplemented by guarded doses of radium from within. There are no contraindications to guarded doses of radium used as supplements to external radiation.

Individual variations in technic are to be expected, but we should be able to agree upon the principles underlying the management of each of the three degrees of this disease.

Regaud's Technic in Cervical Cancer: Use of New Radium Application. H. Swanberg. Radiol., 12:435-446, May, 1929.

The Regaud technic of treating cervical cancer is an efficient, slow, intensive method of radiation therapy, which apparently has a number of advantages over the radiation methods that have generally been used in this country. These are:

1. The preliminary treatment controls to a large extent the accompanying local infection, thus increasing the patients' general resistance.

2. The careful aseptic technic of radium application with change of applicators during the treatment prevents severe infection following the treatment.

3. The small amount of radium used prolongs the radium treatment, thus increasing the possibility of administering the radium when the cancerous cells are in a state of maximal radiosensitivity.

4. The employment of multiple centers of radioactivity with wide distribution offers a more uniform radiation, and permits a large radium dosage to be ad-

ministered, not only to the visible growth, but also to the zone of potential malignancy which surrounds it.

5. The use of heavy filtration protects the normal tissues and avoids severe local reactions with their attending necrosis, and prolongs the treatment, thereby increasing the chance of destroying additional carcinomatous cells.

The use of a new radium applicator aids in the further simplification of the technic by: (1) Providing a single instrument for irradiating the entire uterine canal as well as the vaginal portion of the cervix, thus reducing the number of applicators to two. (2) Being readily adjustable, uterine canals of various lengths may be adequately irradiated. (3) Offering a heavier filtration which permits only a penetrating radiation from the hard gamma rays of the smallest wave length, thus avoiding any caustic radiation, with its attending necrosis and subsequent sloughing. (4) Providing filtration is twice as great in the vagina as in the uterine canal, thus protecting the sensitive vaginal mucosa as there by greatly reducing the possibility of fistula formation. (5) Could be procured at a much lower cost than an applicator of platinum filtration.

Comparative Measurements of the Quality of Roentgen Rays. J. J. Burby. Radiol., 12: 275-282, April, 1929.

The quality of radiation produced by two types of x-ray apparatus has been studied, two different models of each type were available, three dosimeters, two large ionization chambers and one with a thimble chamber, served as measuring instruments. The values obtained on the mechanical rectifier machine agree well with those reported by Pohle and Barnes. The penetration of the radiation produced by a kenetron apparatus does not differ markedly for potentials below 150 k. v. If higher potentials are used, there is a definite increase in the penetration as compared with the mechanical rectifier machines. The filter thickness required for obtaining homogeneous radiation is less for the kenetron apparatus.

La Radiotherapie Dans La Maladie De Raynaud. Monier-Vinard, Delherm et Beau. Bull. et Mem. de la Soc. de Radiol. Med. de France 1929, ann. 17, No. 156, pp. 69-73.

Seven cases with involvement of the arms showed more or less marked improvement following x-raying which was administered on both sides of the cervical and thoracic spinal column. The gangrenous foci localized and sloughed. The crises of local syncope or asphyxia decreased in frequency and painfulness and progressively confined themselves to areas decreasing more and more in size. The arms became more supple. The improvement immediately followed the first irradiations. After a time the action of the roentgen rays seemed to diminish and it proved advisable to separate the irradiation series by longer intervals occasionally used for thermopenetration. The obtained results were generally lasting.

The irradiation of the cervical and thoracic spinal column extends as far as D2, thus involving both the cervical intumescence and the inferior cervical ganglion. If the inferior limbs are also affected, the irradiation is to be applied from D10 as far as L5, thus acting on the lumbar intumescence and lumbar paravertebral ganglia.

The irradiation is focused on two symmetrical fields on the back, focus skin distance 25 cm. with a spark gap of equally 25 cm. filtration through 5 mm. Al., 400 French R per sitting, three sittings a week, from 1200 to 1600 French R being administered on both sides in each irradiation series at three weeks' interval at least. These irradiations can be supplemented by anterior ones.

The authors are therefore of the opinion that Raynaud's disease is to be treated with roentgen rays of medium penetrative power in short irradiation series of the cervicodorsal and dorsolumbar region. These series are to be repeated at intervals conveniently to be utilized for the routine local treatment with diathermy or infra-red rays.

Local Diathermy. M. H. Friedman. J. A. M. A. 92:1648-1653, May 18, 1929.

With their methods the authors have been unable to show any effect of diathermy on the rate of absorption of subcutaneously injected epinephrine or on the rate of absorption of subcutaneously injected phenolphthalein, unless edema was produced. In that case there appeared to be a distinct retardation in the rate of absorption.

Nor were they able to demonstrate any effect of diathermy on the rate of absorption of intramuscularly injected bismuth salts or on the rate of urine secretion.

Suggestive Findings Revealed at Autopsy in Patients Treated by Radiation. A. A. Thiabaudau. J. Cancer Research, 13:66-72.

Radiation therapy cannot be said to have any casual relation in the production of pulmonary embolus. Hydronephrosis is a very common complication of malignancies in the pelvis. It occurs in both radiated and non-radiated cases. A statistical resume is made on three hundred autopsies in cases of malignancies.

Ueber Strahlenbehandlung Der Uterusmyome. M. Meneow. Fortschritte auf dem Gebiete der Roentgenstrahlen, 39:451-458, Mch. '29.

Roentgentherapy of uterine myomas is the method of choice, because the percentage of cures approaches 100 per cent and mortality is nearly null. The intensiveness of the insufficiency phenomena chiefly depends on the constitution of the patients. In order to abate the intensity of the insufficiency phenomena, the technic to be applied ought to be of individual order. Meneow considers as absolute contra-indications to irradiation: pedioled submucous and subserous myomas, pregnancy complicated by myoma, and necrosing myo-

mata. Radium can likewise be used for the treatment of myomata, especially when they are associated with severe haemorrhagias. In every case suggestive of malignancy an exploratory incision should be done.

Die Therapeutische Anwendung Von Roentgenstrahlen Bei Nerven—Und Giesteskrankheiten. H. D. Witzleben. Klinische Woehenschrift 1928, Nov., ann. 7, pp. 2300-2304.

It is understood that success is only to be expected in cases where the tissue stricture allows of responding to radiation, hence chiefly in neoplasms, inflammatory processes and diseases of endocrine organs, whereas cysts, teratomata, gummas and solitary tubercles are ray-proof. The results obtained in neoplasms of the typophysis are rather satisfactory. In especially severe cases it is suggested, first to perform the operative decompression and then to follow up with irradiation. In dystrophia adiposogenitalis irradiation has repeatedly been successful, but the genital function which often becomes normal in acromegaly, was not reintegrated. The pituitary dwarfism is not appropriate to irradiation. Out of the other cerebral neoplasms gliomata are particularly amenable to irradiation; gliosarcomata are very radio-sensitive, too. For inoperable tumors irradiation is, no doubt, the method of choice. According to the authors' opinion irradiation is often preferable also in operable neoplasms, all the more, as the extirpation of hypophyseal neoplasms, for instance, is today still difficult, dangerous (meningitis) and not always successful at all. In other cerebral tumors one will rather decide upon operation, if they are easily accessible, and follow up with irradiation, if their complete extirpation is not possible.

In habitual headache and hydrocephalus irradiation produces considerable retrogression of the disturbances by decreasing the production of the cerebrospinal fluid. As to the spinal neoplasms one should in the majority of cases, especially in extramedullary tumors, make an attempt at operation the results of which are very satisfactory; incomplete removal is followed up with irradiation.

In syringomyelitis irradiation relieves the pains and paraesthesias, motility improves, vasomotor-tropical disturbances recede. The critical appreciation of the results is no easy matter due to the fact that syringomyelitis is an affection of very slow progression and also liable to a spontaneous standstill. This is also in a still higher degree true of the doubtful success of the x-ray treatment in disseminated sclerosis.

The lancinating pains and gastric crises of tabes dorsalis are favorably influenced by x-rays.

Striking success may be obtained in spinal infantile paralysis by roentgentherapy, particularly if it is, as suggested by Bordier, combined with diathermy.

Of the diseases of the peripheral nerves the palsy of the facial nerve is above all to be mentioned for being amenable to successful irradiation. The same is true of occipital neuralgias of the brachial plexus, inter-

costal nerves and lumbago. In sciatica, however, the value of roentgentherapy is a moot point.

There is only little room for roentgentherapy in mental diseases. By irradiation of the sex glands nymphomaniac conditions have improved, though the assumption of a hyperfunction of the ovaries underlying such a treatment is still unproved. Roentgen castration is generally to be forewarned of as it is doubtlessly too much made use of at present.

Beitrag Zur Roentgentherapie Der Lymphogranulomatose Mit Besonderer Beruecksichtigung Der Neueren Klinischen Ergebnisse. Karl Kruchen. Strahlentherapie 31: 623-627, Mch. '29.

Early diagnosis is of value, and radiography of the thorax and gastro-intestinal tract should not be omitted. Before the onset of the roentgentherapy a soft swelling lymph node ought to be extirpated and histologically examined; even with a negative histological finding the suspicion of a lymphogranulomatous affection should not be dismissed in view of the relative frequency of lymphogranulomatosis at the age of from 20 to 40. If the morbid phenomena do not recede in spite of the irradiation of the affected lymph glands and the neighboring ganglia, it is suggestive of an affection of the mediastinal and retroperitoneal lymph nodes. Sometimes the symptoms, especially those of advanced stages, are due to secondary inflammatory phenomena or other complications (pleurisy, tuberculosis), thus only permitting cautious irradiation. The more acute and extensive the affection and the more the anaphylactic phenomena increase in number, the more cautiously is the dosage to be conducted. The blood picture offers a useful therapeutic control. Intensive irradiations would under such conditions produce a further impairment of the blood picture and imperil the patient who then needs mild and cautious treatment.

As to the dosage of the irradiation dose the efficient dose in the first stage is characterized by blood pictures with a normal or slightly increased number of leukocytes and lymphocytosis and amounts to 50-80 per cent of U. S. D.; in the second stage with its characteristic histological finding and hyperleukocytosis 30-70 per cent of U. S. D. are to be administered. The third stage where the histological finding reveals sclerotic changes, hyaline degeneration and necroses, the blood picture lymphopenia, requires only fractional doses.

Radiotherapy demands a suitable general treatment as adjunct. Sufficient pauses for rest should follow fatiguing irradiations.

Die Roentgentherapie Des Spastischen Hustens Und Ihr Einfluss Auf Das Blutbild. Jahrbuch fur Kinderheilkunde 73:200-248, Mch. '29.

The enlargement of the intrathoracic lymph nodes in whooping cough is an important factor in the mechanism of spastic cough. The general condition of the

child, the number and intensity of the seizures allow a conclusion as to the degree of enlargement of the intrathoracic lymph glands. In case of neuropathic diathesis the finding concerning the lymph glands can be insignificant. When whooping cough is superposed on pre-existent tuberculous adenopathy, the latter can for some time, after the whooping cough has receded, cause irritative phenomena of so-called pertussis hilus. The roentgen rays produce the recession of the lymph glands and consecutively the attenuation of the spastic component of the cough and occasionally their complete disappearance. At the check examination made a fortnight after the irradiation, a clearing up of the hilus markings was ascertained. The hilus of neuropaths responds least. The fittest moment for the administration of the x-rays is the convulsive stage about the third or fourth week. Vomiting ceases first within two to five days. Little by little the number and intensity of the attacks of spastic cough decrease. A single skin unit is anteriorly or posteriorly applied to the thorax. The technic of irradiation is to be adapted to the age and development of the child as well as to the stage of disease as indicated by the hilus finding. Size of field 6 by 8 to 8 by 10 cm., focus skin distance 25 to 30 cm., hard rays, 130 k. v. effective, filter 5 mm. Al. or 0.5 mm. Cu., amount of 35-50 per cent of the skin unit of adults. In haematological respect the best effect was obtained in marked lymphocytoses. The explanation of the x-ray effect on the disease itself and on the blood-picture must recur to direct and indirect influences; the elimination of the pressure exerted by the enlarged hilus gland on the bronchi, and the inhibitory effect on their innervation does away with the focus from which the stimuli for the spasmodic cough originate, the mechanical additional component in the genesis of lymphocytosis being thus removed at the same time.

Ueber Den Stand Der Bestrahlungstherapie state of the irradiation therapy of malignant Der Malignen Tumoren. (On the actual neoplasms.) H. Chaoul. Beihefte zur Med. Klin., Ann. 25, 1:9-10, Jan., 1929.

In regard to dosage, size and choice of fields there are no general rules. The amount of dosage to be administered in the irradiation of several fields should be such that the growth and its surroundings receive a dose which approaches the skin unit dose in the depth as much as possible. It shall be borne in mind as a matter of course that: (1) The function of the tissue intervening between the layer to be treated and the surface must not be damaged and, (2) repetition of the irradiation at not too long intervals is possible. Chaoul discerns in the dosage between a feeble S. U. D. equal to 660 R., a medium one equal to 800 R. and a strong one equal to 1100 R., which data depends on the measurement of the primary and secondary radiation. The feeble S. U. D. can eventually be repeated in six weeks, the strong one generally not before 10-12 weeks. It is advisable to limit oneself to a dose of from 660 to 880 R. per port of entry. The total dose is spread over

two or three days with regard to the patient. Generally speaking, the results of irradiation therapy on neoplasms fall short of expectations; constitutional and biological factors are probably playing part here. Cancroids of the skin, as far as they are situated on the surface, are favorable objects. The same is true of carcinoma of the lips as long as it has not yet extended into the mucous membrane. With epitheliomas of the thoracic portion of the gullet the results Chaoul obtained by x-rays are after all so favorable, that he is no longer inclined to acknowledge the superiority of radium treatment unconditionally. Gastric carcinoma falls, no doubt, within the province of surgeons, and in case of inoperable tumors an attempt with x-rays can be made. Carcinomata of the breast should be operated on, if possible. Chaoul considers an after-care irradiation with small doses as indispensable. Sarcomata, too, react quickly and intensively to irradiation, nevertheless Chaoul advises to operate upon them, if possible, with the exception of lymphosarcomata and sarcomata of the sternum. In lymphogranulomatosis the author now administers only tiny doses which he spreads over the whole of the trunk and repeats during four to six weeks, at first every day, then every second or third day.

Anemia Splenica Infantile E Terapia Attinica.
(Splenic infantile anaemia pseudoleukaemic anaemia Jaksch and ultraviolet radiation therapy.) Giovanni Careddu. *Rivista di Clin. Pediatr.*, 27:1-25, Jan., 1929.

The author has treated 12 cases of pseudoleukæmic anaemia during two years.

The ultraviolet irradiation administered in all of these twelve cases with an exposure time of from one to twenty minutes, led seven times to an improvement of the blood picture and general condition, whereas in the remaining five cases the progression of the diseases could not be arrested and ended in death by intercurrent diseases. Favorable results were obtained where the radiation therapy was applied regularly and for some length of time, while the success was moderate or null when the light therapy was administered irregularly or for too short a time.

Klinische Beobachtungen Ueber Schaumbader. (Clinical observations on lather baths.) Blau. *Zeitschr. f. d. ges. Physik. Therapie*, 37:9-18, May, 1929.

Froth or foam baths, particularly the Peng lather bath, are a very valuable medication. Owing to a very plain technic the Peng lather bath can be prepared without any equipment in a few minutes. The Peng package consists of a packet of dry fine-scraped soap flakes combined with a mild chemical principle: the medium, in which the preparation is dissolved, is hot water poured into a common tub, hand's breadth high. Any clean esparto broom or carpet beater will do to prepare a brimful bath of lather. They are indicated in myalgia, rheumatism, neuralgia, gout, sciatica, arthritis,

acne and impetigo, but above all by any form of obesity. The author has obtained a decrease in weight of 200 grams per bath on an average. As a rule males decrease in weight less than women. A temperature of 38° C. has proved to be the optimal "standard water temperature" with which after the preparation of the lather bath a contrasting lather temperature of 27° C. is obtained. The baths were taken from two to three times a week. In the tub the patient must absolutely keep a supine posture of rest, as baring the upper part of the thorax and the nape of the neck influences the success of the procedure; bathing time 20-25 minutes; after the bath from one to two hours' bed rest. In general the influence of a lather bath on the human organism can be paralleled with that of a vapor cabinet bath, it has however the advantage of milder action because it attacks the heart and vessels in a slightly higher degree. Marked heart and kidney complications are contra-indications.

Uterine Fibroids. Fred Lindenberg, M.D. *Calif. & West. Med.*, 31:93-98, Aug., 1929.

Roentgen-ray therapy of fibromyomata yields most excellent results in the interstitial and uncomplicated type of fibroids in which the main symptom is excessive monthly bleeding. That group includes about 25 per cent of all fibroids.

The fibroid pathology, per se, uninfluenced by any associated systemic diseases, determines the indication for x-ray therapy.

A rather mild radiation, the castration dose, is sufficient to produce an amenorrhea and a cure of the patient.

If the diagnosis is correct, success is 100 per cent with no untoward results whatever. Cases of uncertain pathology should preferably receive surgical therapy. The indication should always be made by a competent gynecologist.

Relation Between Structure and Prognosis in Cervical Carcinoma Under Radiation Treatment. Max. Cutler. *New Eng. Jour. Med.*, 200:517. March 14, 1929.

Cutler classified carcinomata of the cervix into three groups depending upon the respective degree of anaplasia of the cells. The adult type (17%) included in the first group, revealed malignant changes in which the cells are well differentiated, adult in character, and with squamous characters. The anaplastic type of group three (21%) includes malignancies highly cellular, anaplastic, with complete loss of differentiation, diffuse infiltrative growth, and with numerous atypical mitotic figures. The second group showed a plexiform arrangement of cells and constituted the largest number (62%). The early cases in the first group responded about equally to either radiation or surgery (from other clinics) but in the more advanced cases the prognosis was poor with radiation. The tumor cells of this group are considered radio-resistant. On the other hand the neoplasms of group three responded best to radiation. The cells of this type of tumor are most sensitive to

radium and consequently respond best to this treatment; whereas surgical therapy in this group has been known to offer a poor prognosis. The comparison of Cutler's statistics under radiation therapy with those of other clinics favor radiation both in early and late stages in the progress of the tumor growth. Neoplasms occurring in the second group offer a prognosis intermediary between the other groups.

Results of X-Ray Therapy in Myoma and Other Non-malignant Lesions of the Uterus. G. M. Laws. Am. J. Obstet. Gynec. 17:855-860, June, 1929.

It is of real value to a gynecologic service to have x-ray treatments given by a standard dosage until sufficient experience is acquired to prescribe a more ideal individual treatment.

The small dosage herein reviewed has enabled us to extend the field of x-ray therapy so that an increasing number of women are referred for treatment each year. The patient is not restricted in her activities except by hospitalization for curettage which is usually indicated. Therefore in practice, x-ray has one important advantage over radium, particularly if small doses are used and must be repeated. If radium is not at hand at the time of curettage, it is less disturbing to apply x-ray later, e. g., after the pathologic report is received.

The contra-indications to small dosage x-ray therapy are few and are practically confined to its effect on ovary and fetus.

Urethra Caruncles. R. E. Loucks, M. D. Am. J. Roentgenol. 21:537-540, June, 1929.

The pathology, predisposing causes and treatment of urethral caruncle are dealt with. Two cases are reported. The tendency to recurrence following surgery or any other form of therapy is emphasized. A proved technique, using a special radium applicator, is described. This technic provides a safe, certain and convenient method of permanently curing a very troublesome, obstinate and by no means infrequently occurring condition.

Tumors of the Salivary Glands Based on a Study of 66 Cases. B. F. Schreiner, M. D., and W. L. Mattick, M. D. Am. J. Roentgenol., 21:541-546, June, 1929.

Two cases of carcinoma of the salivary glands are alive and well two years after treatment by operation and high voltage roentgen rays. One case is well for seven months.

Where the tumor is favorably located, operation, complete or removal of the tumor from its capsule followed by irradiation is the method of choice.

Irradiation by implantation with emanation, radium packs or high voltage roentgen rays is preferable when the tumor is not favorably located for operation.

Operative recurrences of salivary tumors are best treated by irradiation.

Radium Treatment of Carcinoma of the Cervix in 1927. Harry H. Bowing, M. D. Am. J. Roentgenol., 21:529-537, June, 1929.

The year 1927 was a representative period. A review of this sort emphasizes the immediate results and complications noted during the year. Since palliation is all that can be expected in the majority of cases, it is possible to lose sight of this important feature of the treatment in the studies of three-year and five-year figures. Further it is clearly demonstrated that the primary lesion will respond to adequate treatment. Radium is decidedly efficient in the treatment of early and borderline lesions and it is astonishing to what an extent palliation will occur following the proper treatment of the lesions of the other groups.

The broken-dose method applied during what may be termed a brief treatment period offers advantages, especially since individual treatment is of prime importance for good results. Furthermore, the malignant process has certain potentialities for producing complications and these can be properly interpreted rather than charging them to the usual so-called radium reaction. In our experience, there is a definite systemic effect which can be attributed to the therapeutic rays. It has characteristic symptoms which are readily recognized and as a rule, seldom confused with other impending complications, and permits the immediate institution of recognized methods of treatment.

Early recognition of the disease, and immediate proper care of the patient should greatly enhance the results now obtained.

Further Report on the Treatment of Cancer of the Cervix With Radium. O. L. Norsworthy, M.D. Texas St. J. Med. 25:287-292, August, 1929.

More than 50 per cent of cases of cervical cancer fail to reach the competent surgeon until too late to be cured. No method of treatment can be recommended as curing more than 50 per cent of cervical cancers. Hysterectomy as performed by twenty prominent surgeons, shows an average primary operative mortality of 16.7 percent, and an average five-year cure of 44 per cent of patients surviving operation.

Radium as applied by seventeen prominent surgeons, shows less than 2 per cent primary mortality, and 44.1 per cent five year cures of cancer patients surviving treatment. The most effective method for educating the public to the necessity of early diagnosis, is by reducing the primary operative mortality and increasing the number of cures. We cannot lessen the primary mortality nor increase the percentage of cures, by continuing to operate in inoperable cases though classed as operable or borderline.

It is unfair to compare results of radical hysterectomy in any group of cases, which in reality only record those cases in which the patients survive the operation, with the number of cures obtained by irradiation which includes all cases treated in that group. For example, of 100 cases of cervical cancer patients apply-

ing for hysterectomy, only 50 can be accepted as operable, and of this number, 8 will die from the operation. Of the 42 patients surviving the operating, but 15 can hope to live over the five-year period. Of 100 patients applying for irradiation, practically all may be treated; a very large majority benefited; the lives of many prolonged, and 21 of the 50 operable (44 per cent) may hope to pass the five-year period.

Wesen Und Wirkungsart Der Schlamm-Resp. Moorbaeder. (The nature and mode of action of mud and bog soil baths.) W. A. Alexander. Zeitschr. f. d. ges. physik. Therapie, 36:4-12, Oct., 1928.

The nature and mode of action of the mud and bog soil baths consist in: The action of superimposed physical, chemical and biological properties of the mud and bog soil. By virtue of stimulating skin activity, especially the endocrine glands, these effects are conveyed into the depth of the organism where they exert their activating influence on all organs and systems. In the presence of pathological processes, especially of a chronic inflammatory kind, they provoke acceleration of the circulation and metabolism in the lesions together with the elimination of proteins of exudative origin. The effect is in the nature of a true proteinotherapy as demonstrated by the general and local reactions. The results benefit the entire system.

Die Ultraviolet-Therapie Der Oto-Rhino-Laryngologie. (Ultraviolet therapy in otorhino-laryngology.) A. J. Cemach. Strahlentherapie, 32:361-388, April, 1929.

Among all objects of treatment the interest of the light researchers is particularly focused on the larynx. The treatment of laryngeal tuberculosis is carried out according to various methods:

(1) General irradiation with whole carbon arc light baths (Strandberg, Blegvad) without local irradiation, but combined with operative interference in the larynx. Alongside of carbon arc light Strandberg exceptionally also administers quartz light.

(2) Local larynx irradiation by modified carbon arc light according to Wessely's precept. The latter uses especially impregnated proprietary carbons of the firm Goertz, the composition of which has not been revealed as yet. Their light is cooled by a water filter and concentrated into a thin parallel ray pencil; in this form it is said to have an intensity of from 100,000 to 120,000 Hefner candles and a spectrum extending as far as 290 millimicrons, thus being far richer in ultraviolet rays than the common carbon arc. The effect of this "artificial sun light" on tuberculosis of mucous membranes is said to be excellent. Wessely has in the majority of his cases confined himself to local phototherapy. Of late he is combining it with intravenous trypanflavin injections and believes thus to have obtained a substantial increase in the tissue reaction manifesting itself

among others by a strikingly rapid retrogression of the ulcers.

(3) Local irradiation with the quartz mercury lamp. The light of Bach's "artificial alpine sun" is thrown into the autoscopically centered larynx. The light therapy is aided by tuberculin treatment. The author himself combines the direct quartz light treatment with systematic general treatment. Besides specific therapy (tuberculin) confinement to bed and open air cure, diet, in appropriate cases sun baths or general quartz light treatment are applied. He could obtain clinical recovery in 37 out of 62 cases.

As to the nose, eczema, lupus, hay fever and ozena are the most important indications for phototherapy, whereas it is to be noted, that the deeper seated territories were not rendered accessible to phototherapy until the springy quartz rods were devised by the author. These rods are fastened to the Kromayer lamp by means of a rod holder. A geared up stand devised by Cemach allows the exact adjustment of the rods. The endonasal treatment of hay fever by quartz light has met the author's full approval, inasmuch as the symptoms disappeared completely.

Phototherapy can also be relied on in tuberculosis of the middle ear, in that it reacts on all kinds of light containing ultraviolet rays (sun light, quartz light, carbon arc light) and equally well on roentgen ray irradiation.

Ein Neues Schulterlichtbad. (A new shoulder light bath.) B. Berliner. Zeitschr. f. d. ges. physik. Therapie, 36:140-141, April, 1929.

The rheumatic affections of arthritis, arthralgia, and myalgia of the shoulder require management by radiant heat. The routine light cabinet baths of the shoulder are difficult to apply and are very irksome to the patient. Nor do they always warrant the uniform irradiation of the shoulder from all sides. Experience has taught that the irradiation of small parts of the body by open-air electric light bulbs is at least as efficient as that by covered light cabinet baths, often even superior to them. True, light cabinet baths unite radiant heat with hot air, but hot air is not always beneficial, for with open-air irradiation the loss of heat by the irradiated surface of the body is less hampered, the irradiation can be more intense without any risk of burn, and the picture of the stronger dissipation of heat is greater hyperaemia. Therefore Berliner irradiates the humeral region at once with four filament bulbs armed with reflectors anteriorly, posteriorly, upward and sideways. These four open-air bulbs are fitted to a stand and shiftable so that the shoulder can be comfortably placed between the four bulbs. Each of the bulbs is separately adjusted to the optimal distance, the anterior one being in general given a larger distance than the posterior or lateral one on account of the greater sensitiveness of the skin on the front side. The contact of the body with the lamps is prevented by wire hoops. The results are excellent.

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Courtesy of Dr. Richard Kovacs, Adjunct Professor of Physical Therapy,
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MANY cases of acute bronchitis can be jugulated by early use of diathermy. If treated during the first twenty-four hours after the onset, one treatment usually is sufficient. After the first day, more treatments will be required.

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The current is turned on gradually to 500 milliamperes; five minutes later it is slowly increased to the comfortable toleration of the patient. The treatment is continued for twenty minutes, then the current is gradually reduced

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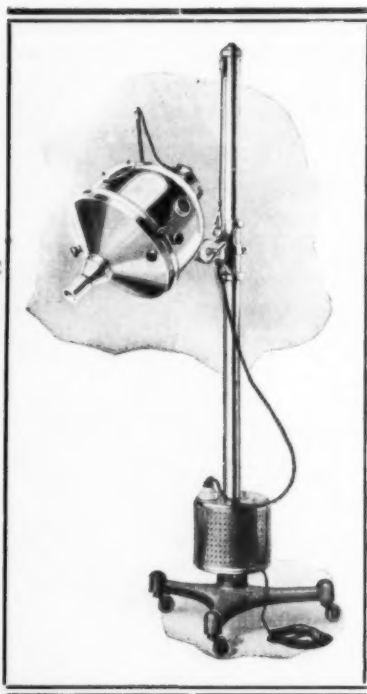
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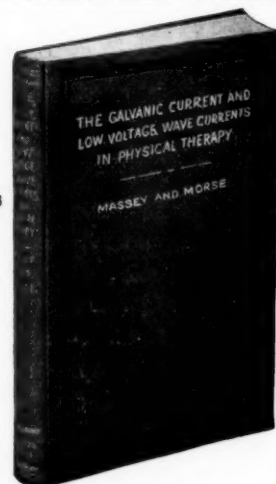
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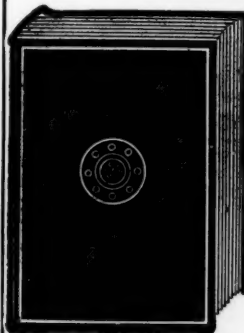
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